BULLETIN OF THE IMPERIAL INSTITUTE

A RECORD OF PROGRESS RELATING TO AGRICULTURAL, MINERAL AND OTHER INDUSTRIES, WITH SPECIAL REFERENCE TO THE UTILISATION OF THE RAW MATERIALS OF THE DOMINIONS, INDIA AND THE COLONIES

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BULLETIN OF THE IMPERIAL INSTITUTE

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FOREWORD

By Sir Harry Lindsay, K.C.I.E., C.B.E.
Director, Imperial Institute

Readers of this issue of the Bulletin will observe that we have introduced an innovation which will, we trust, be also an improvement. We have divided the contents into three sections, dealing respectively with (1) matter relating to plant and animal products; (2) matter concerning mineral resources, their development and utilization; and (3) items of general interest concerning the Institute and its work, including the Exhibition Galleries, Empire and G.P.O. Film Library, etc.

It is hoped that this rearrangement will facilitate the use of the Bulletin by those whose interests lie principally in one direction, whether it be plant and animal products or mineral resources; whilst at the same time facilitating a perusal by all readers of more general information concerning progress with our educational services.

No alteration has been made either in the scope of the Bulletin or in the manner of presentation of the matter. It will continue to contain reports of the more important investigations carried out in the Laboratories of the Imperial Institute which are considered suitable for publication, articles contributed by the staff and by other authorities, notes, recent research on Empire products, bibliography and notices of books.

In the past, under the heading of Recent Research on Empire Products, we have included, in addition to reports contributed by Departments of Agriculture and Forestry

overseas, half-yearly statements on the work carried out by the Geological Surveys of a number of the Colonies and Mandated Territories. These statements, which have been kindly prepared for us by the Officers of the respective Surveys, have given valuable indications of the trend of the work and of the results achieved. It has been felt, however, that a further useful purpose would be served if we could also publish quarterly statements showing the production of the more important minerals in each country of the Colonial Empire, together with brief notes on any interesting developments in prospecting, production or new markets. With this object in view and in order to present information which can be regarded as authoritative, we have written to enlist the help of the Chief Inspectors of Mines concerned. Only a short time has elapsed since we made this appeal, but the promises of help so far received are encouraging, and it is hoped that by this means, if we are fortunate enough to secure the wholehearted co-operation of officers addressed, fresh and useful data concerning colonial mining activities will form an important feature of future issues of our BULLETIN.

THE IMPERIAL INSTITUTE

SCOPE OF ACTIVITIES

THE Imperial Institute was founded as the Empire Memorial to the Jubilee of Queen Victoria. The purposes of the Institute, as defined by the Imperial Institute Act of 1925, are as follows :—

1. To promote the commercial, industrial and educational interests of the British Empire.

2. To collect and disseminate :—

(*a*) information relating to possible uses of and markets for new raw materials or semi-manufactured products ;

(*b*) information relating to new uses of and markets for already-known raw materials or semi-manufactured products ;

(*c*) information relating to sources, production, supplies, cost, consumption and requirements of raw materials and semi-manufactured products and legislation relating thereto ;

(*d*) information relating to the best means of increasing supplies or of creating new sources of supplies of such materials and products within the Empire ;

(*e*) information relating to the best means of treating such materials and products and of preparing them for marketing ;

(*f*) technical and scientific information bearing upon the industries of the British Empire.

3. To advise on the development of the resources of the Empire in raw materials in order that such resources may be made available for the purposes of industry and commerce and of Imperial defence.

4. To conduct in the laboratories of the Institute preliminary investigations of raw materials and, when it may be deemed advisable, to arrange for more detailed investigation by appropriate scientific or technical institutions.

5. To collect samples of raw materials having a definite value in industry and commerce.

6. To co-operate with other agencies within the Empire formed for similar purposes.

7. To maintain for public information and instruction in the Exhibition Galleries of the Imperial Institute exhibitions illustrative of the resources and development of the Empire and of its scenery, life and progress and where practicable to organise from time to time temporary exhibitions of a similar nature elsewhere.

8. To do anything incidental to or conducive to carrying into effect all or any of the foregoing purposes.

Under the provisions of the Act aforementioned, the Institute was reorganised and placed under the control of the Department of Overseas Trade. The Parliamentary Secretary of that Department is the responsible Minister and is President of the Board of Governors. This body consists of the High Commissioners of the Dominions and India, representatives of the Colonial Office and certain other Government Departments, and of the Crown Agents for the Colonies, with additional members representing scientific and commercial interests. A list of the Board of Governors will be found on p. 9. The Director of the Institute is Sir Harry A. F. Lindsay, K.C.I.E., C.B.E.

The technical work of the Institute is carried out by two principal Departments, viz., a Plant and Animal Products Department and a Mineral Resources Department. An Advisory Council for each of these groups of products has been appointed, Sir Frank Stockdale, K.C.M.G., C.B.E., being Chairman of the Plant and Animal Products Council, and Sir William Larke, K.B.E., Chairman of the Mineral Resources Council.

A number of Consultative Committees consisting of authorities on the various groups of raw materials co-operate in the work of the Institute, in association with the Advisory Councils, and close touch is maintained with producers, brokers, merchants, and users. Valuable help can thus be given to persons interested in the development of Empire raw materials.

Inquiries.—The Institute maintains a special service for dealing with inquiries relating to the sources, production, uses and marketing of raw materials and for collecting and disseminating general and statistical information on these subjects. This service is available for the use of individuals and firms, as well as of Government Departments.

Investigations.—The laboratories of the Institute are specially equipped for the chemical and technical examination of raw materials of all kinds. Full reports are furnished on the composition, uses and value of materials submitted. By its close association with the users of raw materials, the Institute is able to arrange large-scale trials of promising materials when necessary.

Investigations on plantation rubber are conducted at the Institute under the supervision of the London Advisory Committee of the Ceylon Rubber Research Scheme and the Rubber Research Institute, Malaya.

Charges for Inquiries and Investigations.—Inquiries and investigations are conducted without charge for Governments which contribute to the general revenues of the Institute. In the case of non-contributing Governments fees on a moderate scale are charged for any work involving a considerable expenditure of time and trouble, while simple inquiries and preliminary investigations, easily carried out, are not charged for. Work is carried out for private firms and individuals, at home and overseas, in general on the same terms as for non-contributing Governments.

Library.—The Library of the Institute contains a large collection of works of reference relating to Empire countries and their products and is regularly supplied with the more

important reports and other publications of Government Departments in Great Britain, the Dominions, India, the Colonies and most foreign countries. More than 800 serial publications, mainly of a scientific or technical character, are also regularly received.

The library is available for the use of inquirers between the hours of 10 a.m. and 5 p.m. on week-days (10 a.m. and 1 p.m. on Saturdays).

Statistical Section.—This section is concerned with the collection of statistics required in connection with the work of the Institute.

Publications.—The BULLETIN OF THE IMPERIAL INSTITUTE contains records of the principal investigations conducted at the Imperial Institute, and articles and notes, chiefly relating to progress in tropical agriculture and forestry, the development of mineral resources, and the industrial utilisation of all classes of raw materials. A summary of research work conducted by Government Technical Departments overseas, reports on current developments in the mineral industries of the Colonial Empire, special bibliographies of publications of a technical and scientific nature, and book reviews are also included.

Other publications of the Institute include a Descriptive List of Some Empire Timbers; a Report on Grading Rules and Standard Sizes for Empire Hardwoods; Monographs on the Preparation of Empire Hides and Skins and the Tanning Materials of the British Empire; Reports on the Collection of Reptile Skins for Commercial Purposes and the Drying of East African Hides; a comprehensive series of some fifty Monographs covering all the important economic minerals and metals under the title of "The Mineral Industry of the British Empire and Foreign Countries"; an Annual Statistical Summary showing production, imports and exports, British and foreign, of all the metals and minerals dealt with in the Monographs; the Mineral Position of the British Empire; a series of twelve volumes on the Mining Laws of the British Empire; and one dealing with Mining Royalties and Rents in the British Empire. The Institute also issues series of photographic picture postcards relating to Empire subjects. A list of the publications and postcards is obtainable on request.

Public Exhibition Galleries.—Visitors to these Galleries find each country of the overseas Empire represented by a Court of its own in which the home life, scenery and industries are artistically reproduced by means of photographic transparencies, photographs and dioramas. Where possible these exhibits are so arranged on the principle of the " travelogue " that the visitor is taken in imaginative sequence through just those scenes which would have met his eye had he been making the actual trip. Specimens of economic products are also exhibited; and, where possible, the specimens are grouped so as to tell the story of the industry concerned. By this means the lessons taught in text-books of geography or of technical industry are reinforced by the system which has now come to be known as " visual instruction." Lectures and demonstrations in the Galleries are given daily by the Guide Lecturers.

At the Central Stand, which is situated at a central point in the Exhibition Galleries, free literature relating to Empire countries and products is distributed and Imperial Institute publications and picture postcards are on sale.

In the Exhibition Pavilion attached to the Galleries, temporary exhibitions of a commercial or educational character are held from time to time.

The Galleries are open free on week-days from 10 a.m. to 5 p.m., and on Sunday afternoons from 2.30 to 6 p.m.

Cinema.—The Imperial Institute maintains a Cinema Theatre in the Exhibition Galleries. The Cinema is equipped with standard size projectors and screen, and modern lighting, heating and ventilating systems, and has seating accommodation for 370 persons. Films illustrating the life, scenery, and industries in the various countries of the Empire are shown daily; copies of the programme, which is changed weekly, are obtainable on application. Special arrangements are made for visits of organised parties from schools and other institutions. Lectures on industries and countries of the Empire are frequently given.

Empire Film Library.—The Empire Film Library was inaugurated at the Imperial Institute by H.R.H. the Duke of Gloucester on Friday, June 14, 1935. It contains a large collection of cinematograph films depicting the industries and agriculture, as well as the life, scenery and products, of the United Kingdom and the Empire overseas. The films are available for loan to schools and other approved institutions in the United Kingdom without charge other than the cost of carriage.

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PLANT AND ANIMAL PRODUCTS

ARTICLES

THE EXAMINATION OF PAPER-MAKING MATERIALS AT THE IMPERIAL INSTITUTE

During the past year important additions have been made to the equipment of the section of the laboratories devoted to the examination of paper-making materials, necessitated by the recent advances in pulp and paper testing, which have led to the development of new apparatus, and an improved technique.

The new equipment consists of the following:

(*a*) a British Standard Sheet Machine,
(*b*) a Lampén mill,
(*c*) a constant temperature—constant humidity room,
(*d*) paper testing apparatus.

The British Standard Sheet Machine, the key item of the new installation, has been evolved by the Technical Section of the British Paper Makers' Association, and its use has been adopted as a standard method, not only by that body, but also by the Canadian Pulp and Paper Association, whilst the Technical Association of the Pulp and Paper Industry of the United States have officially approved of the use of the machine as a tentative standard method. It is thus apparent that the merits of the apparatus have found wide acceptance. Essentially its purpose is to enable sheets of paper to be made from a small quantity of any type of paper pulp, the paper being made under rigidly standardised conditions so that the standard sheets obtained are strictly uniform and capable of comparative tests. It is therefore possible by the use of the Standard Sheet Machine, in conjunction with the paper testing equipment, to determine the strength and other properties of pulps obtained from any new raw materials and assess their value and uses in comparison with commercial pulps. A subsidiary use of the Standard Sheet machine is for the determination of

drainage times, a useful estimation when beaten pulps are under test.

For investigations on the influence of beating on the strengths of pulps a number of different types of apparatus have their advocates. The Lampén mill, which is essentially a ball mill with a 10 Kg., hard bronze ball, has been chosen as the apparatus most suitable for the work carried out at the Imperial Institute. Among the advantages of installing a Lampén mill may be mentioned that it is the apparatus required for the British Paper Makers' Association tentative method for the evaluation of beating effect, that it is extensively used in Europe, and also that its use avoids the trouble which arises from the dulling and wear of knife edges if laboratory beaters are employed.

The constant temperature—constant humidity room fulfils a double function, serving both to house the paper testing equipment and to dry and condition the standard sheets. The room was designed and built by the Institute staff, and the controls devised for it have proved very sensitive and reliable in operation.

The paper testing machines, which include a Schopper tensile machine and a Schopper-Dalén bursting strength tester, are of the conventional type and require no special description.

Since the acquisition of additional equipment has considerably increased the scope of the Institute's investigations of paper-making materials, it may be of interest to give, in very brief outline, the scheme of examination as now carried out.

The raw material is first described and sampled. In the case of timbers special note is made of the age of the wood, its soundness, density, and the size and number of any knots it may contain. A representative portion of the material is then submitted to a chemical examination and, in addition, ultimate fibres are isolated from the material, their microscopic characteristics noted, and their dimensions accurately measured.

These initial tests will at once reveal whether any more elaborate work is justified and will also afford guidance as to which pulping processes may be satisfactorily employed. Thus, if the cellulose content proves to be very low, it is

immediately apparent that the material will be valueless for paper-making purposes. Or again, if the material is rich in resin, then it is known that the sulphite process, which is not applicable to resinous materials, will not be a suitable method of digestion.

The foregoing tests having proved satisfactory, the second stage of the investigation is reached, viz. the laboratory pulping trials. The Institute laboratories are equipped with a small, bronze, rotary digester which is employed for alkaline process digestions and a stainless steel digester of small capacity in which sulphite digestions are carried out. It is consequently possible to undertake paper-making trials using any of the three major commercial processes, viz., the soda process, the kraft process, or the sulphite process.

After the completion of the digestion, by whichever process may have been employed, the yield of pulp is determined, and standard sheets are prepared, conditioned and tested. Bleaching trials may be carried out, in which case standard sheets from the bleached pulp will also be made and tested. Finally, the effect of beating on the pulp may be determined by running samples for different periods in the Lampén mill, according to a standard procedure and making and testing standard sheets from the beaten pulps.

In practice, a number of digestions must always be carried out, and the complete examination of a paper-making material is a lengthy investigation. In the first place, a series of digestions is necessary because more drastic cooking conditions must be employed when a bleachable pulp is to be produced than when the pulp is intended for use in the unbleached state. And secondly, it is essential to gain information as to the influence of alterations in the conditions of digestion on the yield and character of the pulp, in order to ascertain as nearly as possible the optimum cooking conditions and the maximum yield of pulp of satisfactory quality obtainable from the particular material under consideration.

From the foregoing brief account it will be seen that the laboratories of the Imperial Institute are in a position to undertake comprehensive investigations of paper-making materials in accordance with the best modern methods. A great deal of useful preliminary work on the paper-making value of Empire raw materials has already been carried out

at the Imperial Institute. The ever-increasing pressure on existing sources of the world's paper-pulp must, gradually but inevitably, direct attention to the possibilities of developing new sources of supply and new raw materials. It is to be anticipated therefore that full and reliable investigations will be required to be made on Empire materials and for such purposes the facilities now available at the Institute should prove of value to the Governments concerned.

THE WORLD'S CINCHONA BARK INDUSTRY—I

General Considerations

At the present time by far the greater part of the world's output of cinchona bark is produced in the Netherlands East Indies. The most important, in fact about the only, producing country in the British Empire is India, but that country still has to import large quantities of quinine in order to meet the requirements of its sufferers from malaria who are estimated to amount to some 100,000,000 at any particular time. India, too, is the only Empire country, other than the United Kingdom, which possesses factories for the manufacture of quinine from the bark.

The question of making the Empire self-sufficient in the matter of cinchona and quinine, or at least of very greatly increasing production in the Empire, is therefore one of considerable importance.

The Netherlands East Indies are particularly favourably situated for the production of cinchona. The climate and soil of the Preanger Residency in Java, where most of the estates are situated, are ideal for the growth of the tree, whilst the Government and planters have behind them well over half a century of experience based on a profound scientific study of the cultivation and improvement of the tree. Any British country would therefore be at a disadvantage in competition with the Dutch producers. Against this, however, it has been urged that the question of supplies of febrifuge for the treatment of malaria is not one to be determined solely by economic considerations.

Apart from India, the most promising parts of the Empire for cinchona production appear to be Malaya, Tanganyika and

the Cameroons under British Mandate. Experimental work has been carried out in these countries indicating that areas exist suitable for cultivation with cinchona and in the two last-named plantations had already been established by the Germans before the war.

The possibilities of producing cinchona in the Empire, particularly in East Africa, have for some years past been a special concern of the Colonial Advisory Council of Agriculture and Animal Health. In 1932 a sub-committee of the Council, after considering the relevant facts, reported against any immediate extension of cinchona production, one important reason being the fact that synthetic febrifuge drugs (plasmoquine, atebrine, etc.) were being manufactured, and it was thought at the time that developments were likely in the near future which would result in the extensive adoption of synthetic products more efficacious than quinine, rendering increased supplies of quinine unnecessary.

However, synthetic febrifuges have not yet become generally available at prices that would compete with quinine, and, moreover, it would seem that the use of such drugs is attended with some risks, for which reason they cannot be distributed generally for use without medical supervision. Accordingly in 1935 the question was again considered by a sub-committee of the Colonial Advisory Council, who this time reported that despite the progress made in the production of synthetic anti-malarial compounds it was probable that for many years to come large quantities of quinine would be necessary and that in the circumstances the production of quinine in the Colonial Empire ought to be encouraged.

In investigating possibilities in different countries it is recognised that trials need not be limited to the species richest in quinine, viz., *Cinchona ledgeriana*, which is particularly exacting in its requirements as to soil, temperature, moisture and altitude, but that in some districts it may be more advantageous to grow other species better suited to the locality even though their yields of quinine may be lower. In this connection the question had come to the fore of using the "mixed alkaloids" of cinchona instead of separating quinine from the other alkaloids (quinidine, cinchonine, cinchonidine, etc.) with which it is associated. This considerably reduces the cost of extraction and also involves less complicated

technical processes. Such mixtures have been prepared under the name "totaquina." In view of the variation in proportions of the various alkaloids in the barks of different species it is necessary that such a product should be to some extent standardised, and, according to the specification of the Malaria Commission of the League of Nations, totaquina must contain at least 70 per cent. of crystalline alkaloids, of which not less than 15 per cent. must be quinine, amorphous alkaloids not exceeding 20 per cent. These requirements permit of the preparation of totaquina from barks of comparatively low quinine content, such as *C. succirubra*. The nature of the totaquina obtained from the bark of this species, however, differs from that which can be prepared from *C. ledgeriana* and further information as to its efficacy is required. The Cinchona Sub-Committee of the Colonial Advisory Council have expressed the view that until the results of further medical trials are forthcoming it is impossible to pronounce an opinion as to whether it would be desirable to concentrate on the cultivation of *C. succirubra* for the preparation of one kind of totaquina or of *C. ledgeriana* for the production of quinine or what has been called "totaquina type 2."

As regards the position of experimentation in the Colonial Empire, the Cinchona Sub-Committee, in a report submitted to the Colonial Advisory Council at a meeting held on October 21, 1936, indicated that, on the evidence then available, it appeared that cinchona could be grown satisfactorily in the Usambara Hills in Tanganyika. It was not, however, considered that, at the present stage, it would be desirable to embark on a large state-owned plantation enterprise. It was pointed out that provision had been made for the establishment of 100 acres of cinchona at Kwamkora adjoining Amani, and at the same time there was evidence that provided planting material could be made available at reasonable rates coffee estates in the Usambaras might be prepared to undertake cinchona cultivation. The Committee considered that the position in the Territory should be re-examined at the end of five years, by which time further evidence should have become available.

The Committee recommended that in Kenya and the Cameroons under British Mandate experimental trials should be undertaken, possibly on the lines which have been decided

in Malaya, where a number of trial plots of different types of cinchona are being established in various parts of the Cameron Highlands.

In recent years the production of cinchona bark in the Colonial Empire has been considered rather from the point of view of providing raw material for the febrifuge needed by the local inhabitants than of producing bark to compete in the world's market with the Java product. The question thus arises of the location of the factory for making quinine. Such a factory needs the constant supervision of a fully-qualified and experienced scientific and technical staff, which naturally increases the overhead charges. At the same time the essential need is for a supply of quinine cheap enough to be within reach of the poorest sufferers from malaria. The Superintendent of Cinchona Cultivation in Bengal has expressed the opinion that the smallest factory unit which could be run economically should have an output in the neighbourhood of 15,000 lb. of quinine sulphate a year and that a production of substantially less than this amount would scarcely justify the maintenance of the necessary expert staff. The bark produced on an area of about 120 acres would be required each year to meet the demands of a factory of this size, so that on a 10-year rotation plantations occupying an area of 1,200 acres would be necessary for each factory.

The Cinchona Sub-Committee consider that Malaya is the only country in which the consumption of quinine is at present sufficient to justify the erection of an economic factory unit. It has been suggested that bark produced in all the African colonies should be treated at a factory, or factories, in East Africa, but this is regarded as being impracticable. An alternative suggestion is that manufacture might be centralised in the United Kingdom and in the view of the Sub-Committee this appears to have a good deal more to commend it.

Species of Cinchona: Their Alkaloid Content and Cultural Requirements

The genus *Cinchona*, belonging to the natural order *Rubiaceæ*, comprises a number of species, mostly small trees, which are native to the mountains of tropical South America between the latitudes 10° N. and 19° S. The classification of the group has presented considerable difficulty to botanists,

owing to the facility with which the species hybridise with one another, giving rise to many different forms.

Four species only have been cultivated to any extent as a source of alkaloids. These are: *C. ledgeriana* Moens ex Trimen (known also as *C. calisaya* Wedd. var. *ledgeriana* Howard), from which Ledger Bark is obtained, *C. succirubra* Pavon ex Klotzsch, the source of Red Bark, and finally *C. calisaya* Wedd. and *C. officinalis* Linn., yielding Yellow Bark and Crown Bark or Loxa respectively. Two hybrids may also be mentioned, namely, *ledgeriana* × *succirubra*, known as Ledger Hybrid or sometimes as *C. hybrida*, and *officinalis* × *succirubra*, which is usually called *C. robusta*. At the present time practically the entire supply of cinchona bark in commerce is obtained from *C. ledgeriana* and *C. succirubra*.

There is a wide range in the alkaloid content of the barks from different species and from different strains of the same species, while even within a single strain the percentage found is subject to considerable variation, depending upon climatic and soil conditions and also on the age and state of the tree. In the individual plant the alkaloid content increases up to the age of approximately eight or ten years, the time being partly dependent on soil and other external conditions; after this the bark tends to become poorer in alkaloids and in an old tree the decrease may be quite marked. This falling off in alkaloid content is noticeably earlier in trees which show premature flowering. Of the distribution in different parts of the tree it may be said that the root-bark is normally richest in total alkaloids, while the bark at the base of the trunk contains a slightly lower proportion, which gradually decreases upwards to the branches. This condition is not necessarily true of individual alkaloids, which sometimes show a tendency to concentration in the bark of the trunk, as is the case with quinine in *C. ledgeriana*. In a plant of this species the alkaloids of the stem-bark may consist of nearly 90 per cent. of quinine, while those of the root-bark contain about 60 per cent.

Not only does the total alkaloid content vary with the different species and strains, but also the relative proportions in which the different alkaloids are present. This proportional composition of the total alkaloid in the bark is, however, more or less characteristic for each species, although by no means constant.

The following table gives an indication of the usual range of alkaloid content in the barks of the principal species and hybrids now cultivated. The composition of bark from hybrid plants is particularly liable to variation.

Alkaloid Content of the Barks of Different Species of Cinchona

	Total Alkaloids.	Quinine.	Cinchonidine.	Quinidine.	Cinchonine.	Amorphous Alkaloids.
Species :	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
C. ledgeriana .	5–14	3–13	0–2·5	0–0·5	0–1·5	0·2–2
C. calisaya . .	3–7	0–4	0–2	0–3	0·3–2	0·2–2
C. succirubra .	4·5–8·5	1–3	1–5	0–0·3	1–2·5	0·3–2
C. officinalis .	5–8	2–7·5	0–3	0–0·3	0–3	0–1·5
Hybrids :						
C. ledgeriana × C. succirubra ("C. hybrida") .	6–12	3–9	0–3	0	0·5–1·5	1–2·5
C. officinalis × C. succirubra ("C. robusta") .	6–8·5	1–8	2·5–6·5	0–trace	0–1	1–2

It will be seen that, generally speaking, the bark of *C. ledgeriana* is richer in quinine than that of any other species, while *C. succirubra* may have a high content of total alkaloids and is sometimes particularly rich in cinchonidine. The Ledger hybrid, resulting from the cross of these two species, has also produced bark with a very high content of quinine.

It must be borne in mind, however, that a high alkaloid content is of little value if the yield of bark is poor and the latter factor must therefore be taken into consideration in selecting species for cultivation. In addition, cultural problems are obviously of vital importance and here it may be mentioned that *C. ledgeriana* is often extremely difficult to rear in some regions where other species will grow vigorously.

The natural distribution of the genus *Cinchona*, taken as a whole, covers a very limited geographical area, and it is found that in cultivation the different species have similar climatic requirements. Summarised briefly, the most suitable conditions are a tropical climate and an elevation of from 3,000 to 6,000 ft.; a fairly high average temperature with relatively small range of variation, high atmospheric humidity, high rainfall well distributed throughout the year, a light well-drained soil rich in organic matter, and a sloping situation but sheltered from the wind. Generally speaking, the ecological conditions favourable for the growth of cinchona are those which would support a natural vegetation of evergreen rain forest.

As a concrete example may be quoted the climate of Java, which is eminently suited to the cultivation of cinchona. The rainfall in the cinchona growing areas is between 100 and 150 in. annually, with about three months of relatively dry weather, and the average relative humidity is over 70 per cent. at mid-day and over 90 per cent. in the morning and evening, the plantations frequently being enveloped in cloud. The mean monthly temperatures at different times of the year vary only between 68° and 73° F.

The cultivation of most species of *Cinchona* is not, however, strictly limited to conditions such as these, as some have been grown successfully in a much drier climate, as that of Madras where the annual rainfall is only 45 in. and considerable periods of drought occur. Unsuitable conditions may, however, influence the content of alkaloids, even though the plants appear healthy. This is the case with low altitudes, where the trees will grow vigorously, but may have a greatly reduced yield of quinine and in addition are short-lived and more susceptible to disease. At higher altitudes again the yield is reduced, but here growth is slow and the plants are easily killed by frost. Generally speaking, *C. officinalis* succeeds better than other species at high altitudes, while *C. succirubra* is the most accommodating species.

It has already been mentioned that *C. ledgeriana* is more exacting in its requirements than any other species. The most suitable climatic conditions for satisfactory bark production of high quinine content would appear to be those obtaining in Java at elevations of 4,000 to 5,000 ft. The character of the soil is also of great importance in the case of this species; its first essentials are that it should be friable and of good depth, the best results in Java having been obtained on such soils recently clear of forest. Other species, especially *C. succirubra*, on the other hand, will thrive and give relatively good yields of alkaloids under conditions where *C. ledgeriana* would fail. For this reason and owing to the uncertainty of successfully re-establishing *ledgeriana* on old cinchona lands attention has been paid to the question of grafting the latter species on the more vigorous *succirubra* stock. This has proved highly successful and practically all the Ledger bark now being produced in Java is harvested from grafted trees.

Little is recorded about the requirements of the Ledger Hybrid ("*C. hybrida*"), which has given such promising bark-analyses. It has been grown in Java both on its own root and grafted on to *succirubra*, but it is now largely replaced by grafted *ledgeriana* and is no longer cultivated to any great extent.

As regards propagation, vegetative methods are preferable, as the progeny from seed is apt to be unreliable unless special precautions are taken owing to the occurrence of hybridisation between different strains and species. In Java plants which are specially selected for their high yield of quinine are grown for seed in gardens isolated from the rest of the crop, where there can be no risk of contamination.

Direct shade is said to be generally harmful to the young trees, but belts of virgin forest between the plantations are helpful in maintaining the necessary humidity of the atmosphere.

THE PRESENT POSITION OF THE PRODUCTION OF CINCHONA BARK AND QUININE

In the following account of the state of cinchona production and experimentation in the different countries of the world, the Netherlands East Indies, from its pre-eminence in the industry, is dealt with first, followed by India, the most important Empire producer. Particulars of the work which has been done in other Empire and foreign countries will be given in the next issue of this BULLETIN.

NETHERLANDS EAST INDIES

The exact area under cinchona in the Netherlands East Indies cannot be given, as the official statistics relate only to such estates as send in returns. In 1937, 105 estates made returns, of which 101 were in bearing. Of these 105, 96 are situated in Java (44 in Preanger Residency and 24 in Buitenzorg); the other 9 are in Sumatra. The total area planted with cinchona on these estates was 42,489 acres (37,358 acres in bearing), and the amount of dry bark harvested was 22,975,981 lb.,[1] which probably represents about 90 per cent. of the total production of the country. It is believed that there

[1] Figures converted from metric tons.

has been more expansion in planting in the Netherlands East Indies in recent years than is indicated by the official figures and the Government has appointed a Commission to investigate the whole position of the industry.

It is estimated that the Netherlands East Indies now produce over nine-tenths of the world's supply of cinchona bark. This extraordinarily strong position has been attained not only as a result of favourable climatic conditions, but also through the systematic thoroughness with which the industry has been carried on from the start. The earlier work was of particular importance as it laid down the lines for future development, and the rapid rise of the industry owes a special debt to the scientific insight of Moens, who played a prominent part in the direction of the Government Cinchona Plantations during this early period.

One of the first problems which engaged the attention of the Dutch growers was that of determining which of the various introduced species would give sufficiently high yields of alkaloid to repay cultivation on a large scale. The first analyses of Javan Ledger bark in 1872 gave a solution to this problem, for the significance of its high quinine content was quickly realised and attention was thenceforth centred on the cultivation and improvement of *ledgeriana* for quinine production. It was the success of this policy which played a large part in bringing about the downfall of the cinchona industry in Ceylon, where *succirubra* was grown. The high yields of quinine obtained from *ledgeriana*, and the prominence accorded to this alkaloid, rather to the neglect of other cinchona alkaloids, made it impossible for *succirubra*, with its lower proportion of quinine, to compete under difficult market conditions.

Over a period of many years the methods of cultivation and propagation in the Netherlands East Indies have been steadily improved by the experimental work carried out on the Government Cinchona Plantations at Tjinjeroean. The original Ledger plants were of very mixed character, but scientific research and rigorous control in the selection and breeding of new high-yielding varieties have given a stock of the highest quality. It is interesting to note in this connection that as early as 1878 a quinine content in the bark of 9 to 10 per cent. or more was demanded on the Government plantations for trees from which seeds or cuttings were taken for propagation.

In the earlier selection work the value of the trees was assessed principally by the percentage content of quinine found in the bark, and little or no account was taken of such factors as the thickness of the bark or its rate of growth, which greatly influence the total yield of quinine. It is only within the last 25 years that a satisfactory quantitative method of estimating the yield of alkaloids has been devised, thus putting the later selection work on a sounder basis.

Another important aspect of the Dutch work relates to the problem of continuous cultivation of cinchona on the same soil. Mention has already been made of the difficulty of growing *ledgeriana* on old soils, and of the introduction of a grafting technique whereby *ledgeriana* scions could be grown on stocks of the more robust species such as *succirubra*. This provided a means of combining the high-yielding qualities of the former species with the hardiness of the latter, but did not remove the problem of soil deterioration. Erosion losses have now been largely prevented by terracing and the provision of adequate drainage, and various manurial treatments have been applied to improve the soil. Leguminous cover-crops are being grown as green manure between the rows of cinchona plants on the young plantations, whilst for regenerating old cinchona land the growing of a green manure crop for two or three years before replanting has been suggested. Although the earlier experiments with artificial manures seem to have been inconclusive, more recent work in this direction has indicated the advantage of using fertilisers, particularly nitrogen and phosphate manures, where the fertility of the soil has become depleted. Generally speaking however, the soil fertility in Java is naturally high and the addition of artificial fertilisers is unnecessary.

Mention must also be made of the strong economic position of the industry in the Netherlands East Indies, which is maintained by co-operation between the growers and quinine manufacturers through the "Cinchona Agreement" of 1913. Prior to this agreement there were periods of overproduction when the price of the bark fell so low that the industry was threatened with extinction. Since 1913, however, the supply of bark has been regulated according to the demand and in this way prices have been maintained at an economic level and the position of the growers stabilised. The administration

of the Cinchona Agreement lies with the Kina Bureau in Amsterdam, which is made up of representatives of the growers and the quinine manufacturers. As about 10 per cent. of the total bark production of Java is from plantations directly controlled by the Government it will be seen that the Government influence in this Agreement is of some importance.

Since early in 1934 the production of bark has been further regulated by the introduction of an export quota system. The Government decrees annually the maximum amount of cinchona, expressed as quinine sulphate, that shall be provided with export licences, but provision is made for increasing the amount should the demand for quinine warrant such action.

In 1935 the quantity of bark handled under licence was 20,273,686 lb.[1] (equivalent to 1,408,752 lb.[1] of quinine sulphate), of which about 82 per cent. was intended for shipment overseas and the remainder used in the quinine factory at Bandoeng.

For 1936 the export quota was fixed at 1,646,851 lb.[1] (expressed as quinine sulphate equivalent), but in order to meet the heavy demand for quinine throughout the world the quota was increased in November by 157,630 lb.[1] The export quota for 1937 was fixed at 1,470,481 lb.[1] (quinine sulphate equivalent), a considerably lower figure than for the previous year. The quotas for 1938 and 1939 have been progressively lower. The producers of bark have benefited greatly by this restriction scheme, and on the recommendation of a committee appointed to investigate its working it was decided to extend the scheme for a further ten years from January 1, 1937.

In 1936 the quinine industry of the Netherlands East Indies enjoyed the greatest prosperity that it has had since 1930. The exports of bark in 1936 amounted to 19,978,463 lb. (£1,026,012) and of quinine 6,774,646 oz. (£411,584). During 1937 shipments of bark were substantially less than during 1936, but exports of quinine rose somewhat. Shipments of bark rose again in 1938, but those of quinine were smaller. The actual figures were: 1937, bark 13,961,831 lb. (£736,349), quinine 7,329,152 oz. (£409,446); 1938, bark 15,337,801 lb. (£919,721), quinine 6,430,407 oz. (£395,112).

[1] Figures converted from metric tons.

India

During the earlier period of cinchona cultivation the Indian policy aimed at building up an industry which would supply sufficient quinine to meet the country's needs. With the rise in importance of the industry in Java this ideal was gradually abandoned, but it revived with the War conditions and by 1917-18 the possibility of making the whole Empire self-sufficient, largely through India's supplies, was under serious consideration. At this time the reserve stocks of quinine held by the Government of India had been considerably depleted, and for a number of years it was necessary to supplement the production of the bark with supplies imported from Java. It has not, however, been found practicable under existing conditions to produce quinine in India at prices which will compete with Java and the output still falls far short of the present requirements of the country. The need for increased supplies of cheap quinine and the difficulties in the way of meeting the demand are discussed by C. C. Calder, the Superintendent of Cinchona Cultivation in Bengal, in his Annual Report for the year 1935-36, from which the following extracts may be quoted :

" The present high level of prices in cinchona products is essentially due to the difficulties of production. If the raw material were easy of production the manufacture of sufficient supplies of quinine would be easy enough, but cinchona as a plant is exacting in its demand and it is not everywhere or under any set of conditions that it can be successfully exploited. Costs of production are high, competition is restricted by reason of the climatic and soil requirements of cinchona and these combined explain high world prices.

" It is fortunate that in India areas exist fairly suitable to the cinchona plant and experience has shown that it can be cultivated here at costs which would allow of a cheapening of quinine for the masses. When the public recognise this fact and finance is forthcoming there is no reason why a forward cinchona policy should not be adopted with every prospect of success. Experimental cultivation could be started under suitable conditions in different parts of the country, and all the accumulated experience of the existing cinchona organisations in India would be available to draw upon. But the success of such effort, if it is to be truly national, would seem to depend on a co-ordination of all the provincial efforts. Only certain

provinces in India, however, are fortunate in having suitable areas, and with the inauguration of provincial autonomy under the new constitution it would seem that the Central Government alone could bear the responsibility of such a national policy, so that the less fortunate provinces also may benefit. For under the present economic conditions it is not likely nor is it reasonable to ask that those provinces which can produce would make revenue sacrifices in the interest of others."

During the last few years the position of the industry has changed but little, and production of the bark is still practically confined to Bengal and Madras. It has recently been reported, however, that the Government of Assam has under consideration an experimental cinchona plantation scheme extending over an area of 15 to 25 acres. A number of trees are stated to have been planted already on a 4-acre plot near Nongphoh. The plantations in Lower Burma will be discussed separately in the subsequent part of this article.

The areas under cinchona on the Government plantations of Bengal and Madras, as given in the annual reports for the last three years available, are shown in the following table. This does not include plantations under private ownership.

Area under Cinchona on Government Plantations
(*acres*)

	Bengal.	Madras.
1934–5	2,585	1,942
1935–6	2,664	1,949
1936–7	2,762	1,991

No statistics are available for the total production of bark in India, but the quantities collected on the Government plantations attached to the quinine factories in Bengal and Madras in the last three years for which figures are available have been as follows :

	Bengal.	Madras.
	lb.	*lb.*
1934–5	1,095,369	192,271
1935–6	1,329,302	204,206
1936–7	1,452,311	307,895

In Madras the local supplies of good quality factory bark from private sources are stated to be practically exhausted. This means that during the next few years the output of bark from the Government plantations will have to be doubled in order to meet factory requirements, and considerable extension

of the plantations will be necessary if this output is to be maintained.

The botanical source of the bark collected on the Madras plantations is not indicated in the official reports, but the bulk of the trees being raised in the nurseries consists of "*C. robusta*." Most of the Bengal bark is obtained from *ledgeriana* with small quantities of *succirubra*, *officinalis* and hybrids.

The quantities of quinine sulphate made in the Government factories are shown below:

	Bengal.	Madras.
	lb.	*lb.*
1934–5	56,561	17,414
1935–6	51,026	9,760
1936–7	57,313	17,130

In both factories there is also a large production of "cinchona febrifuge" and smaller amounts of other cinchona salts and of totaquina.

There is a small export of cinchona bark from India, but this consists mainly, if not entirely, of "druggist's" bark. The quantity shipped during 1937-38 is given as 28,222 lb.

NOTES

The Late Mr. E. R. Bolton.—It is with very great regret that we announce the death on February 10, 1939, in his 61st year, of Mr. E. Richards Bolton, F.K.C., F.I.C., F.C.S., M.I.Chem.E., the well-known analytical and consulting chemist. Mr. Bolton had been a member of the Imperial Institute Consultative Committee on Oils and Oilseeds since its formation in 1926, and in 1933 became its chairman and a member of the Advisory Council on Plant and Animal Products; he was also chairman of the Sub-Committee on Tung Oil, which has done so much to foster the cultivation of tung trees in the Empire. In these capacities he rendered valuable service to the Institute, being always ready to place his time and wide knowledge at its disposal.

Mr. Bolton's activities covered a wide field, and in addition to his consulting practice he served on the boards of several companies. He had represented Great Britain on an international commission on oils, and had served on many official committees. In his time he had been a member of the Council of the Chemical Society, a Vice-President of the Institute of Chemistry, Secretary and President of the Society of Public Analysts, a member of the General Council of the British

Standards Institution and chairman of its Technical Committees on Vegetable and Marine Oils, and a Vice-President of the Medico-Legal Society of London. He had written either alone or in collaboration with others authoritative books on oils and fats, and had also contributed sections to standard works and numerous papers to scientific journals.

Tung Oil in Indo-China.—As far back as 1900, 6,000 metric tons of Tung oil were exported from Indo-China, but by 1931 exports had ceased. Since that year there has been a gradual increase once more in the exports, until they amounted to 226 tons in 1936, and for the first nine months of 1937 the figure was 647 tons. The cause of the reduced exports is ascribed to the poor quality of the oil, due to adulteration and to faulty preparation. An illustrated article by L. Réteaud dealing fully with the present position of the industry is published in *Bulletin Économique de l' Indochine*, 1938, **41**, No. 2, pp. 354-375. A brief account of the experimental work on the tree being undertaken by the Institut des Recherches Agronomiques et Forestières, is given in the following issue (No. 3, pp. 574-578).

The more common species of Tung tree occurring in Indo-China is *Aleurites montana*, known locally as Abrasin. It is found in Tonkin and North Annam and also at Laos, while plantations have been started in Cochin China. Both male and female flowers appear on the same tree. Often male flowers occur in greater proportion than the female ones, even up to as high a figure as 98 per cent. Studies are in progress by the Institut des Recherches Agronomiques et Forestières with a view to determining the factors responsible for the preponderance of male or female flowers. It has been noticed that the proportion of male to female flowers is more nearly equal on trees growing at high altitudes and on rich, well-fertilised soil, e.g. at Tran-ninh (1,100 metres), than on trees growing on the poor soils in the low-lying district of Middle Tonkin Female flowers are found in some cases in normal proportions on trees which have been nearly free from them during preceding years. Indications have been given that the proportion of female flowers, on which the possible yield of fruit depends, even if it is a hereditary factor, is equally influenced by the conditions of climate and soil. On the other hand it has been noticed that some trees, which bore male flowers one year, carried female ones in a succeeding year and *vice versa*. On other trees the proportion of male to female flowers remains constant each year.

If satisfactory yields of fruit are to be expected, it is recommended that the trees should be planted on good, deep soil. Although a spacing of 8 × 8 metres is preferred, it is

considered advisable to plant the seedlings 4 × 4 metres, and then subsequently to thin out the inferior ones. A number of nurseries have been established in Tonkin and North Annam as well as in South Annam and in Cochin China. In the latter district a plantation of 600 hectares has already yielded its first crop.

Work on selection has been started by the above-mentioned Institute. About 800 trees at Son-Tay have been examined and been graded into four groups, viz., those which yield 20-25 kilos. of fruit per tree per annum; those with a yield of 10-20; those with a yield of 5-10 and those yielding less than 5 kilos. Seeds from selected trees have been distributed to various nurseries in Indo-China in order to demonstrate whether they will breed true to type. As it has been found that in many cases seeds fail to germinate on being sown, the reasons for the loss of germinating power have been investigated. It has been determined that poor germination may be due either to lack of care in establishing the nursery or to the poor germinating power of the seed. The viability of the seed has been found to deteriorate rapidly, and it is therefore recommended that sowing should take place within a month of harvesting. Drying the seed in the sun causes loss of germinating power. For transit over long distances the seed should be packed in charcoal. The texture of the shells also has an influence on germination, the thicker shells having an adverse effect. A botanical study of the trees has been commenced with a view to the correlation of their characteristics with the yield of fruit. Some progress has been made in this connection and experimental sowings have been made to show whether the seedlings produced will have the characteristics of the parent trees.

In Indo-China the trees flower in March and April, and the harvest takes place during the months of August to October. The fruits fall to the ground and are picked up. They readily dehisce, and the nuts are accordingly easily separated from the husks. The nuts should be dried carefully in thin layers and kept in a dry place as their condition influences the quality of the oil.

Two modern crushing plants have recently been erected in Tonkin and North Annam, but in most cases the oil is prepared in native presses. These, if properly worked, are quite satisfactory, provided sound nuts are used and the expression is not carried too far. For the preparation of the oil the nuts are broken by hand and the kernels picked out. These are ground in a mortar, heated, formed into cakes and then pressed in crude native presses made out of tree trunks. Using these presses three crushings can be made each day, equivalent to 300 kilos. of nuts or 60 kilos. of oil. In the

modern presses the quantity of nuts treated per day is from 10 to 12 tons. The residual press-cake is used as a fertiliser and the proceeds from its sale pay a good part of the cost of crushing in a native press.

The production of Tung oil in Indo-China is still small and will not increase appreciably for another three years, by which time the recent new plantings of Tung trees will be commencing to yield crops. In the meantime the quality of the oil being produced in Indo-China is being improved through the efforts made by the official authorities.

Cultivation of Roselle Fibre in Java.—In a note on roselle fibre (*Hibiscus sabdariffa*) published in this BULLETIN, 1937, **35**, 465, brief reference was made to the attempts to develop the cultivation of the plant in the Netherlands East Indies. The following account of the prospects of the crop for cultivation by natives is taken from a translation of a statement by the local government kindly furnished to the Imperial Institute by the Department of Overseas Trade.

Roselle is grown in Java only on a limited scale on the European estates and the cultivation is still to a considerable extent of an experimental nature as regards the cultivation technique, as well as the fibre production and the sale of the product.

From the results obtained so far by the estates, the impression has been received that roselle is a crop which needs a lot of water, not only from the point of view of cultivation but also for the fibre production. With regard to the time it takes to grow, which is from 7 to 8 months, this crop can only be successfully grown by the native population on their rice fields if they have sufficient irrigation water at their disposal during the east monsoon.

Roselle moreover needs good soil, while to obtain a product of good quality great care has to be given in its cultivation.

It will take the entire west monsoon and part of the east monsoon to grow roselle, which makes it almost impossible to grow other crops on the fields. Especially in districts where there is no, or only a slight, surplus of food products, the cultivation of such a crop, which occupies the land for such a long time, and the sale of which is not yet sufficiently assured, carries with it a risk for the supply of food.

Apart from the estates which make their own bags from the roselle fibre grown on the estate, the sale of this product —still little known on the world market—is not sufficiently certain. This applies in particular to the inferior qualities of fibre which would be produced eventually in larger quantities by the native growers than the European estates.

The cultivation of roselle for export by native growers

would, even if they are conversant with the technique of the cultivation and the preparation of the fibre, most certainly leave a loss at present quotations.

Whether the cultivation by natives would be a paying proposition if they were able to sell their fibre to bag factories which might eventually be established in Java, is still problematical.

In connection with the above it is not possible to give an affirmative reply to the question whether the cultivation is a paying proposition for native growers.

This matter is nevertheless having the continual attention of the authorities.

The General Agricultural Experimental Station is making regular experiments on their fields with the cultivation of this crop, while a study is being made of the sales possibilities of roselle fibre. If these experiments, as well as those on the estates, offer some prospects for native cultivation, experimental fields will be laid out in the most suitable districts in co-operation with the native population.

The Production of Chamomile Flowers.—There are two cultivated forms of chamomile which enter into commerce, the material derived from the so-called English or Roman chamomile (*Anthemis nobilis*), which is a perennial plant, and that from the German chamomile (*Matricaria chamomilla*), which is an annual plant. The former, which is cultivated in this country and various continental countries, is the source of the product commonly marketed in the United Kingdom. It is used for toilet and medicinal preparations and was formerly official in the British Pharmacopoeia.

Chamomile does not appear to be an exacting crop so far as soil conditions are concerned, as it will grow on both clayey and sandy soils, but the best results are stated to be obtained from deep, light, rich and fresh soils.

The land must be thoroughly clean, requires deep cultivation, and farmyard or artificial manures must be applied as required.

In Europe the crop is planted from December to March or even late April, but the earlier planted areas are said to give the best yields. The plants are generally propagated by means of one-year-old slips, which are obtained from selected plants. Propagation from seed is generally unsatisfactory, as a proportion of the plants is liable to produce single flowers, which are not required by the market. The slips are planted, in clumps of three or four, in rows 1½ ft. to 2½ ft. apart, separated by 15 in. in the row. Regular weedings are called for during the growing period.

The crop may remain on the same land for several years,

in which case the plants require thinning to remove excess or irregular growth. More satisfactory results, however, are obtained, and yields are better maintained, when the crop is ploughed in and the land replanted with slips every two or three years.

Flowering usually begins in June when the plantations were laid down in March, and the flowers improve as the season advances. The collection of the flowerheads is a continuous process which takes place just as the flowers open and become fully developed; gathering should not take place when the flowers are wet with dew or rain, as this tends to turn them black. Picking, when done by hand, is mostly carried out by women and children, who harvest from 12 or 13 lb. to 16 or 17 lb. a day. Yields ranging from 400 to 1,000 lb. of dry flowers are stated to be obtained from one acre, depending on the season.

Drying should be effected as rapidly as possible under conditions which enable the flowers to retain their white colour. The exact method to be followed will, naturally, vary according to local conditions. The drying may be carried out in the sun on racks or trays or in heated drying sheds or lofts. The flowerheads are spread out in thin layers and turned at intervals in order to prevent overheating and consequent deterioration. When the drying process has been completed the flowerheads are graded and packed in paper-lined plywood boxes.

International Bibliography of Agricultural Economics.—The International Institute of Agriculture in Rome has just issued the first number of a new quarterly publication, consisting of a current bibliography dealing with agricultural economics in all its various phases. This bibliography, which is based on the material received by the Library of the Institute, is compiled under the technical direction of the Librarian, Dr. S. von Frauendorfer.

The International Bibliography of Agricultural Economics covers the economic and social aspects of agriculture, such as agricultural economics, agricultural policy, settlement, credit, co-operation, insurance, marketing, prices, statistics, farm organisation and management, valuation, labour, accounting, rural sociology, agricultural history and geography, legislation and education, and all other agricultural problems, in so far as they are considered from the economic and social point of view. Only publications of purely technical character are excluded. Titles of all publications, whether books, bulletins, pamphlets or articles in periodicals, are indicated, including all bibliographical details required for proper identification.

All languages receive equal treatment and titles in the less-known languages are provided with a translation.

The bibliography is systematically arranged by subjects, and an author-index will be supplied at the end of each volume. Copies are obtainable from the International Institute of Agriculture, Villa Umberto 1, Rome, the annual subscription being 6*s.* 6*d.*, including postage.

RECENT RESEARCH ON EMPIRE PRODUCTS

A Record of Work conducted by Government Technical Departments Overseas

AGRICULTURE

Soils

Montserrat.—Mr. W. E. Bassett, Curator of the Agricultural Department, states in his report for the half-year ending December 31, 1938, that late in 1938 preliminary investigations were begun in Montserrat with the object of determining methods which could be applied in practice under the local conditions to check soil erosion. Three plots, each having an area of approximately one acre, were laid out side by side on fairly steep land. Contour lines about twenty feet apart were marked out on all plots by the use of a dumpy level. A different method of erosion control is being tried in each plot. These methods are: (*a*) stone wall terracing, the stone walls being 4 ft. wide with a distance of some 16 ft. from wall to wall; (*b*) grass strips 4 ft. wide along the contours with a similar distance between the strips as between the walls just mentioned; and (*c*) contour ridging. The grass strips consist of triple lines, the clumps of grass being planted 15 in. apart, and the grasses used include lemon grass, Guinea grass, elephant grass and vetiver grass. Similar strips have also been planted with such leguminous plants as *Tephrosia candida*, Bengal bean, and a mixture of *Crotalaria* species. Crops to be grown will include cotton and sweet potatoes. Work on the experiment had made considerable progress by the end of the year.

Palestine.—According to a report for the half-year ending December 31, 1938, the work of the Soil Research Laboratory at the Jewish Agency Agricultural Research Station, Rehovot, during the period under review was mainly centred on different problems in soil salinification. The continuation of the soil survey revealed a widespread danger of salinification through unwise irrigation in different regions. In the Harod area, the decline of the clover crop yields was clearly shown to be due

to salinity. The saline nature of the Acre-Haifa Bay soils was traced to the high salt content of the underground water. A study was carried out in these areas of the relative effect of different methods of irrigation on (*a*) the accumulation of salt in the soil, (*b*) the yield rate, and (*c*) the nutritive quality of the crops obtained. More frequent irrigation with lesser quantities of irrigation water was found to be beneficial. The clear-cut advantage of flood over furrow irrigation was demonstrated in all three respects.

Analysis of the movement of potassium fertiliser in profiles of red sandy soil is being continued. It was found that a considerable portion of the water-soluble, available and exchangeable potassium fractions are leached out of the profile, particularly from the upper soil layer, by five irrigations in the course of the summer.

A paper on "The Effect of Sheep and Goat Manure on some Mediterranean Soils" was published by M. Puffcles and S. Adler in *Soil Science*, Vol. 46, No. 4, October 1938.

INSECTICIDES

Pyrethrum

Palestine.—According to a report on research work carried out during the half-year ending December 31, 1938, seeds of Pyrethrum introduced from Kenya in 1936 were grown at the Horticultural Stations, Ein Arrub and Sarafand. The following is an analysis of the heads collected in the summer of 1938, undertaken by the agricultural branch of the Central Laboratories, Department of Health :

	Approximate content of Pyrethrin I. *Per cent.*
Ein Arrub No. 1 (indigenous)	0·07
Ein Arrub No. 2	0·3
Sarafand No. 1	0·5
Sarafand No. 2	0·5
Sarafand No. 3	0·4
Imported Powder	0·5

BEVERAGES

Cocoa

Gold Coast.—The report of the Department of Agriculture for the period July-December 1938 states that investigations into the cause and treatment of "Swollen Shoot" and die-back have been continued. The rooting of cuttings in the Imperial College of Tropical Agriculture type propagator has been fairly good, and these cuttings have been bud-grafted with material from infected plants, with a view to continued investigation of the virus theory, and to test the effect of various chemical treatments. The area at Apedwa was kept under

observation, and it was found that new outbreaks of swollen shoot had occurred, in each case associated with die-back. Observations on cocoa at Akrokerri appeared to indicate that Cundeamor cocoa was less susceptible to die-back, and an experiment has been laid down to compare Cundeamor, Amelonado, and an intermediate type of cocoa.

Experimental work showed that exposure caused stunting and malformation of the branches. The symptoms were somewhat similar to die-back and swollen shoot, but a soil deficiency factor is also suggested. Root mapping indicated that die-back is associated with low soil moisture content, which inhibits growth of root hairs except in the surface 3 in.

Progeny trials and the investigation of compatibility continued. An experiment has been laid down to determine the pollinating agent, which appears to be different from and more efficient than that in Trinidad.

SUGAR

Cane

St. Vincent.—The following summary of a Progress Report on the Syrup Industry of St. Vincent for the period ended June 30, 1938, prepared by Mr. C. C. Seale, Crop Specialist (Sugar) of the Agricultural Department, has been furnished to the Imperial Institute. The work, which was made possible by a grant from the Colonial Development Fund, is now drawing to a close.

Controlling the Manufacturing Process.—Prior to the inception of the scheme the method of manufacture was not carefully controlled and consequently very great fluctuations in quality existed. During the past three years these fluctuations have been considerably reduced and improvements in quality effected by the introduction of the essential features of chemical control and the standardisation of the manufacturing methods. Investigations are also being carried out to determine the feasibility of filtration as a further means of improving quality.

Manurial Experiments.—Manurial experiments were laid down on sugar cane to determine the manurial requirements of this crop. The results of one of these trials tend to confirm those carried out on other crops, namely, that a highly significant response is generally obtained from applications of nitrogen supplied as sulphate of ammonia, which indicates a deficiency of nitrogen in the soils of St. Vincent.

Pests.—The major pests of sugar cane in St. Vincent are the small moth borers (*Diatraea saccharalis* and *D. canella*). The damage caused by these pests was determined by counts made in the factory yards of several estates during the reaping

seasons. These counts indicate that the percentage joint infestation during 1936, 1937 and 1938, was 11·01, 19·40 and 21·04 respectively. It is believed that the introduction of suitable parasites might be beneficial in reducing the incidence of these pests.

Large Scale Blending.—The blending of the produce from the various estates was strongly recommended as a means of obtaining uniformity in the quality of the syrup intended for export. During 1938 the largest local exporter erected a blending plant, and approximately 80 per cent. of this year's production was blended before shipment. This resulted in a considerable reduction in the fluctuations of the characteristics which collectively constitute quality.

Government Controlled Grading and Certification System.—In February 1938, on the recommendations of the Crop Specialist, Government made an Order-in-Council to control the exportation of syrup from St. Vincent under a suitable grading and certification system. In accordance with the Order-in-Council referred to above, all syrup is required to be graded before shipment, and certificates issued denoting the grade obtained. There are two grades, namely:

(1) Extra Fancy Molasses,
(2) Extra Heavy Fancy Molasses.

All syrup not falling within the specified limits of these standards is classified as Fancy Molasses Ungraded. The grades are defined by the following characteristics, namely, density, polarisation, *p*H, colour, clarity and flavour.

Root Crops

Cocoyams

Gold Coast.—According to the report of the Department of Agriculture for the period July-December 1938, there have been serious outbreaks of root-rot of cocoyams at Aburi and Oda. Cultures of infected tissue show the presence of *Rhizoctonia* sp., but the organism does not produce the symptoms on healthy plants growing in the sterile medium. Observations on soil have showed that soil from an infected farm will infect healthy plants. A pot experiment has been laid down, with treatment as follows:

(*a*) 6 pots of soil from healthy farms,
(*b*) 6 pots of soil from diseased farms,
(*c*) 6 pots of a mixture of 5 parts soil from healthy farms and one part soil from diseased farms.

To date the plants in (*a*) are in good health, those in (*b*) are stunted and wilting, and those in (*c*) are stunted and about

half of them are wilted, i.e. the healthy soil appears to have diluted the effect of the soil from diseased farms. Other experiments showed that maize grown in healthy soil gave better growth than in soil from diseased farms, and it is thought that a soil deficiency which enhances the virulence of the organism is the predisposing factor. An experiment has been laid down to determine the effect of shading with plantains.

FRUITS

Citrus

Dominica.—Mr. F. G. Harcourt, Agricultural Superintendent, reports that during the half-year ended December 31, 1938, the trials reported six months ago have been continued, but owing to adverse weather conditions, progress has been rather slow, and there is little to add to the last report.

Lime Breeding.—Twenty-three hybrids were selected as worthy of further trial and were transplanted at 14 ft. × 10 ft.

Stock Trials for Limes.—Yields of limes budded on grapefruit stock continue to be higher than those on sour orange, which in turn are higher than those on rough lemon.

Grapefruit and Orange Varieties.—The trees have made slow growth, and the crop was rather small and matured late owing to unseasonable weather.

Plant Distribution.—Over 13,000 budded citrus plants were distributed, mainly to small holders. Stocks for budding in 1939 were badly retarded by abnormally wet weather.

Economic Section, Botanic Gardens.—Only slow progress is to be recorded. The heavy rains experienced rendered further anti-erosion work necessary, including the reconstruction of existing drains, culverts and silt pits, provision of additional contour drains and extension of cover crops.

Lime Experiment Station.—Satisfactory progress has occurred. Returns were affected by a drop in the prices of all lime products.

Top-working of Citrus Trees.—The Department has continued this work, which consists chiefly in the crown-grafting of seedy grapefruit trees to either Marsh grapefruit or Washington Navel oranges.

Gold Coast.—According to the report of the Department of Agriculture for July-December 1938, the study of citrus fruit piercing moths was continued during the period. A comparison of weekly and fortnightly harvesting and removal of fallen fruits showed that the weekly treatment reduced the percentage of piercing of total potential crop from 78 per cent.

to 65 per cent. at Aburi, and from 90 per cent. to 82 per cent. at Asuansi. *Othreis* spp. were mainly responsible. There was a high loss at both places and a more positive means of control is necessary. The following table gives the distribution of the various species collected :

Place.	*Othreis* spp. *Per cent.*	*Achaea* spp. *Per cent.*	Other fruit piercers. *Per cent.*
Aburi . .	47	39	14
Asuansi .	48	26	26

There was the highest incidence of moth at the peak of fruit development. The life history of *Othreis fullonica* was investigated, and additional larvae food plants were added to those already known. Trials with various poison baits showed them to be ineffective.

An investigation of grapefruit for canning showed that fruit picked one week before maturity gave the most satisfactory flavour and consistency, but fruit picked two weeks before maturity gave a satisfactory product if stored for four or five days before canning.

Grapes

Palestine.—According to a report on research work conducted in Palestine during the half-year ending December 31, 1938, in field experiments carried out by the Plant Protection Service of the Department of Agriculture and Fisheries on the control of the grape berry moth (*Polychrosis botrana* Schiff.), negative results were obtained from the use of commercial Derris and Pyrethrum products. This is stated to have been due to the rapid breaking down of the active principles of these insecticides under the climatic conditions of Palestine. The best results were obtained with a mixture of 50-70 per cent. of sodium fluosilicate dust and 50-30 per cent. of sulphur or talc. The sodium fluosilicate should be of 98 to 99 per cent. purity. Three to four applications are necessary. The last application can safely be made up to within ten days of harvesting the grapes. Sodium fluosilicate can easily be washed off the grapes ; washing is very essential when the fruit are to be used for wine making.

Mango

Palestine.—According to a report on work carried out by the Jewish Agency Agricultural Research Station, Rehovot, during the half-year ending December 31, 1938, acclimatisation experiments on mango are being continued. It is suggested that good quality mango varieties could be successfully and

profitably grown on light soil in the coastal plain. An experimental shipment of mango fruit to London was undertaken in September. The condition of the fruit on arrival in London was good.

Plums

Palestine.—An investigation was conducted by the Horticultural Service of the Department of Agriculture and Fisheries, Palestine, during the half-year ending December 31, 1938, as to the keeping qualities of two Japanese varieties of plums, Wickson and Kelsey, under cold and ordinary storage conditions.

The results achieved showed that neither variety can be kept in Palestine under ordinary storage conditions for more than a few days. Stored for five weeks at a temperature of 1-2° C. Kelseys improved in both colour and taste, but Wicksons deteriorated. Fruit wrapped in ordinary paper gave better results than those unwrapped or wrapped in oiled paper. Boxes packed with one layer of fruit showed less wastage than in those with two layers.

Tomatoes

Montserrat.—Mr. W. E. Bassett, Curator of the Agricultural Department, points out in his report for the half-year ending December 31, 1938, that considerable quantities of tomatoes are produced in Montserrat for export, and it is usual to allow the plants to grow unsupported on the ground. In view of the blemishes on the fruit sometimes caused thereby, and also the amount of fungus damage occurring, a small experiment was laid down to observe the effects of different methods of supporting the plants so as to prevent the fruits coming in contact with the soil. Staking, tying the plants to wire fences and bamboo fences, and allowing the plants to grow over brushwood laid on the ground were the methods tried. All the methods appeared to tend to have the desired effect. In view, however, of the extra trouble and expense involved it is doubtful if the methods suggested will be generally adopted in the Island. The lack of shelter from strong winds in many of the places where tomatoes are grown would also seem to militate against the success of staking tomato plants unless the method was combined with the use of windbreaks.

Fodder Crops

Palestine.—According to a report for the half-year ending December 31, 1938, the work carried out by the Jewish Agency Agricultural Research Station, Rehovot, includes the introduction of new forage and cereal crops into modern farm practice in Palestine, which continues to be the major

preoccupation of the Agronomy and Seed-Breeding Division. Among summer-grown green forage crops, promising results have been recorded. Teff grass (*Eragrostis tef*) gave five cuts during the summer season, and a yield of 6 tons per dunam. Pearl millet (*Pennisetum spicatum*) produced 4-5 tons per dunam, and may now be tried on an economic scale in different parts of the country. The use of sunflowers as a green forage has been tested with favourable results. This crop can be sown in early spring before any other forage, and gives a feed which, though coarse in texture, is satisfactory. The Whip-poor-will and Brabham varieties of cow-peas have now been firmly established in agricultural practice on both light and heavy soil. Yields obtained range from 25-40 tons of green matter per dunam, the water requirement being 250-300 cu. metres and the length of the growing season 8-10 weeks.

Among winter forage crops the following deserve mention: Field peas, particularly the Dun variety, horse beans (*Vicia faba minor*), Ochrus, sweet lupin, and several varieties of vetch.

Results of promise have also been obtained in experiments on pasture crops. Rhodes paspalum, and Sudan grass among the perennials give high hopes. Attention is now being turned to the annuals.

The working out of a cheap but adequate farm-grown feed ration for dairy cows was also undertaken by the Jewish Agency Agricultural Research Station, Rehovot, during the period under review. A group experiment with cows on a farm-grown fodder ration containing 80 per cent. green forage has been carried into its second year. The results to date are satisfactory in regard both to the health of the cows and the quantity and quality of the milk.

A study of the chemical composition and nutrient value of different forage crops and concentrates revealed that green forage crops grown in Palestine, though of normal digestibility, contained an exceedingly low quantity of total digestible nutrients per unit of fresh weight. This defect is partly compensated for by the high yields. A further improvement, it is hoped, will be effected by careful determination of the proper harvesting time. Work on this aspect is now in progress.

The use of orange culls as a succulent cow feed has been studied. Cows eat this feed readily and can profitably consume 30-35 kg. of fruit per day. The orange contains approximately 12 per cent. (fresh weight) of total digestible nutrients, and possesses one and a half times the nutritive value of Palestine first clover cuts.

Silage experiments on orange peel and Topinambour (Artichoke) tubers have been conducted on an economic scale with favourable results.

Oil Seeds

Coconuts

Gold Coast.—According to the report of the Department of Agriculture for the period July-December 1938, a disease of coconuts was reported at Weh, in Keta district. The symptoms were discoloration and withering of the leaves, followed by death. The disease appears to be a physiological root rot caused by soil conditions. Soil samples have been taken for examination by the chemist.

Tobacco

Gold Coast.—According to the report of the Department of Agriculture for the period July-December 1938, further attacks of leaf curl have been recorded at Aburi and Oyoko on Bourbon tobacco. Similar symptoms have for the first time been recorded on two wild plants, apparently *Acanthospermum hispidum* and *Vernonia amygdalina*. Experiments were carried out on control by roguing and control of the insect vector by three repellants. To date an Egyptian material, Katelsousse, appears to show promise. A heavy attack of leaf curl coincided with a heavy infestation of white flies (Aleurodids) in September.

A tobacco wilt was investigated, and appeared to be caused by a *Phytophthora* or a *Pythium* (*P. solanaceum*).

BIBLIOGRAPHY

Comprising the more important reports, articles, etc., contained in publications received in the Library of the Imperial Institute during the three months November 1938-January 1939.

The publications issued by the Governments of the Colonies and Protectorates can be obtained from or through the Crown Agents for the Colonies, 4 Millbank, Westminster, S.W.1. Applications for Dominion and Indian Government publications may be made to the Offices of the High Commissioners or Agents-General in London.

AGRICULTURE

General

Report and Proceedings of the Conference of Colonial Directors of Agriculture held at the Colonial Office, July 1938. Pp. 130, $9\frac{1}{2} \times 6$. (London: H.M. Stationery Office, 1938.) Price 2*s.*

Report of the Government Chemist upon the Work of the Government Laboratory for the year ending March 31, 1938. With Appendices. Pp. 48, $9\frac{1}{2} \times 6$. (London: H.M. Stationery Office, 1938.) Price 9*d.*

Seventh Annual Report of the Minister of Agriculture, Eire, for 1937-38. Pp. 237, $9\frac{1}{2} \times 6$. (Dublin: Government Publications Sale Office, 1938.) Price 2*s.* 3*d.*

Seventy-second Report of the Queensland Acclimatisation Society from April 1, 1937, to March 31, 1938. Pp. 12, 8 × 5. (Brisbane: Queensland Acclimatisation Society, 1938.)

Administration Report of the Director of Agriculture, British Guiana, for 1937. Pp. 43, 12½ × 8¼. (Georgetown, Demerara: "The Argosy" Company, Ltd., 1938.)

Report of the Department of Agriculture, British Honduras, for the year 1937. Pp. 46, 12½ × 8. (Belize: Government Printer, 1938.)

Report of the Department of Agriculture, Burma, for the year ended March 31, 1938. Pp. 281, 9½ × 6¼. (Rangoon: Superintendent, Government Printing and Stationery, 1938.) Price Rs. 3 As. 8.

Report of the Agricultural Stations, Department of Agriculture, Burma, for the year ended March 31, 1938. Pp. 240, 9¾ × 6½. (Rangoon: Superintendent, Government Printing and Stationery, 1938.) Price Rs. 6.

Annual Report of the Department of Agriculture, Cyprus, for the year 1937. Pp. 58, 13 × 8½. (Nicosia: Government Printing Office, 1938.) Price 3*s.*

Report of the Department of Agriculture, Colony of the Gambia, for the period ending May 31, 1938. Pp. 39, 13 × 8¼. (Bathurst: Government Printer, 1938.)

Report on the Work of the Indian Trade Commissioner during 1937-38. Pp. 96, 9½ × 6. (London: High Commissioner for India, 1938.) Price 4*s.* 3*d.*

Annual Report of the Imperial Council of Agricultural Research, India, for 1937-38. Pp. 168, 9½ × 6½. (Delhi: Manager of Publications, 1938.) Price As. 12.

Annual Report of the Director of Industries, Bihar, for the year 1936-37. Pp. 90, 9½ × 6. (Bihar, Patna: Superintendent, Government Printing, 1938.) Price As. 12.

Annual Report of the Department of Agriculture, Mysore, for the year 1936-37, with the Government Review thereon. Pp. 202, 13 × 8. (Mysore: Department of Agriculture, 1938.)

Report on the Department of Agriculture, United Provinces, for the year ending June 30, 1937. Pp. 87, 9½ × 6. (Allahabad: Superintendent, Printing and Stationery, 1938.) Price As. 6.

Italian Agriculture. By C. Longobardi. *J. Minist. Agric.*, 1939, **45**, 1040-1053.

Annual Report of the Department of Agriculture, Jamaica, for the year ended December 31, 1937. Pp. 83, 13 × 8¼. (Kingston: Government Printer, 1938.)

Vegetation Types of the Colonie du Niger. By J. Dundas. *Pap. No.* 15, *Imp. For. Inst. Oxford.* Pp. 12, 10½ × 8½. (Oxford: Imperial Forestry Institute, 1938.) Price 3*s.* 6*d.* Mimeographed.

Annual Report of the Department of Agriculture, Nyasaland Protectorate, for the year 1937. Pp. 68, 13 × 8. (Zomba: Government Printer, 1938.) Price 2*s.* 6*d.*

Annual Report of the Department of Agriculture and Fisheries, Palestine, for the year ended March 31, 1938. Pp. 77, 13 × 8. (Jerusalem: Printing and Stationery Office, 1938.) Price 2*s.*

Report on the Agricultural Department, St. Kitts-Nevis, 1937. Pp. 54, 13 × 8. (Trinidad: Imperial College of Tropical Agriculture, 1938.) Price 6*d.*

Report of the Agricultural Department, St. Vincent, for the year 1937. Pp. 43, 13 × 8. (Kingstown, St. Vincent: Government Printer, 1938.) Price 6*d.*

Annual Report of the Department of Agriculture, Seychelles, for the year 1937. Pp. 33, 13 × 8. (Victoria, Mahé: Government Printing Office, 1938.)

Annual Report of the Department of Agriculture, Sierra Leone, for the year 1937. Pp. 70, 9½ × 6. (Freetown : Government Printer, 1938.)

The Report of the Governing Body, the Principal's Report for the year 1936-37, and the Accounts for the year ended August 31, 1937, of the Imperial College of Tropical Agriculture, Trinidad. Pp. 38, 10 × 6. (London and Trinidad : Imperial College of Tropical Agriculture, 1938.)

Annual Report of the Department of Agriculture, Uganda, for the year ended December 31, 1937. Part I. Pp. 60, 9¾ × 6. (Entebbe : Government Printer, 1938.) Price 3*s*. A record of the administration and education sections of the Department.

The Value of Botanical Survey and the Mapping of Vegetation as Applied to Farming Systems in South Africa. By J. A. Pentz. *Mem. No.* 19, *Bot. Serv. S. Afr.* Pp. 15 + 13 plates, 9½ × 6. (Pretoria : Government Printer, 1938.) Price 2*s*. 6*d*.

Report of the Secretary of Agriculture, United States of America, for 1938. Pp. 160, 9 × 6. (Washington, D.C. : Superintendent of Documents, Government Printing Office, 1938.) Price 20 cents.

Plant Growth Hormones and their Uses. By W. G. Templeman. *Pharm. J.*, 1938, **141**, 627-629.

The Value of Plant Hormones or their Substitutes in Plant Propagation. By T. W. Brown. *Malay. Agric. J.*, 1938, **26**, 414-419.

The Present Stage of Studies on Substances Stimulating Plant Growth and the Possibilities of their Practical Application. By G. Stampa and G. T. Kalé. *Int. Rev. Agric.*, 1938, **29**, 419T-426T.

The Effect of Hetero-Auxin on Root Formation by Cuttings and on Grafting. Part I. By M. Evenari and E. Konis. *Palest. J. Bot.* (*Jerusalem Series*), 1938, **1**, 13-26.

Comparative Effects of Cobalt, Nickel and Copper on Plant Growth. By W. E. Brenchley. *Ann. Appl. Biol.*, 1938, **25**, 671-691.

Growing Plants without Soil by Nutrient Solution Methods. By W. G. Templeman and S. J. Watson. *J. Minist. Agric.*, 1938, **45**, 771-781.

Electro-cultural Methods Practised in Parts of Northern India. By V. Ramanatha Ayyar. *Madras Agric. J.*, 1938, **26**, 374-382.

Weeds of Grass Land. *Bull. No.* 41 (*2nd Ed.*), *Minist. Agric., Lond.* Pp. 156, 9½ × 6. (London : H.M. Stationery Office, 1938.) Price 5*s*. Contains descriptions and illustrations of the chief weeds and suggestions for their control, and discusses general methods making for the improvement of grass lands.

Chemical Control of Ragwort. Experimental Work at Ruakura. By F. B. Thompson. *N.Z. J. Agric.*, 1938, **57**, 315-320.

The History and Distribution of *Solanum torvum* Swartz in Fiji with Notes on the Possibility of its Control. By B. E. V. Parham. *Agric. J. Fiji*, 1938, No. 3, 2-5. The plant is a serious pest of pasture land in Fiji.

Poisonous Plants on the Farm. By H. C. Long. *Bull. No.* 75, *Minist. Agric., Lond.* Pp. 106, 9½ × 6. (London : H.M. Stationery Office, 1938.) Price 2*s*.

The Soil

Les Sols de l'Afrique Centrale, Spécialement du Congo Belge. Tome I. Le Bas-Congo. By J. Baeyens. *Publ. Inst. Nat. Étude Agron., Congo Belge, Hors Série*, 1938. Pp. 388, 9½ × 6½. (Brussels : Institut National pour l'Étude Agronomique du Congo Belge, 1938.) Price 150 fr. A comprehensive study of the general pedological properties and fertility of the soils of the Lower Congo.

Bibliography on Soil Erosion and Soil and Water Conservation. Compiled by S. H. Gaines, with abstracts by F. Vincent, M. Bloom and J. F. Carter. *Misc. Publ. No.* 312, *U.S. Dep. Agric.* Pp. 649, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 60 cents.

Land Reclamation and Improvement in Europe. By G. Costanzo. *Int. Rev. Agric.*, 1938, **29**, 451E-476E, 532E-542E, 568E-578E.

Soil Erosion and Conservation in Jamaica, 1937. By H. H. Croucher and C. Swabey. *Bull. No.* 17 (*New Ser.*), *Dep. Sci. Agric. Jamaica.* Pp. 20, 9½ × 6. (Kingston, Jamaica: Government Printing Office, 1938.) Price 6*d.*

Bovengrondsche Afstrooming en Erosie op Java. By C. Coster. *Tectona*, 1938, **31**, 613-719. Deals with the question of surface run-off and erosion in Java. Summary in English.

Soil Conservation Districts. How Farmers can Organise Them: How they Help Control Soil Erosion. *Ext. Serv. Circ. No.* 290, *Wis. Coll. Agric.* Pp. 22, 9 × 6. (Madison, Wisconsin: College of Agriculture, 1938.)

Soil Defense in the North-East. By G. K. Rule. *Frms'. Bull. No.* 1810, *U.S. Dep. Agric.* Pp. 70, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 15 cents.

Soil Erosion. The Construction of Contour Banks. By L. J. H. Teakle and N. Davenport. *J. Dep. Agric. W. Aust.*, 1938, **15**, 346-355.

Strip Cropping for Soil Conversation. By W. V. Kell and G. F. Brown. *Frms'. Bull. No.* 1776 (*Revised*), *U.S. Dep. Agric.* Pp. 39, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Native Woody Plants of the United States. Their Erosion-control and Wild Life Values. By W. R. Van Dersal. *Misc. Publ. No.* 303, *U.S. Dep. Agric.* Pp. 362, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price $1.75.

Experiments in Compost-making. By R. C. Wood. *Emp. J. Exp. Agric.*, 1938, **6**, 350-368. Summarises the results of a number of experiments on compost-making carried out at the Imperial College of Tropical Agriculture, Trinidad.

Nitrate Production in Soils as Influenced by Cropping and Soil Treatments. By W. A. Albrecht. *Res. Bull. No.* 294, *Mo. Agric. Exp. Sta.* Pp. 22, 9 × 6. (Columbia, Missouri: Agricultural Experimental Station, 1938.)

Effect of Borax Top-dressing on Boron Status of Soil and Fruit. By H. O. Askew, R. H. K. Thomson and E. Chittenden. *N.Z. J. Sci. Tech.*, 1938, **20**, 74A-78A.

Insecticides

(See p. 65.)

Foodstuffs—General

Native Food Crops of Fiji. By L. W. Harwood. *Agric. J. Fiji*, 1938, No. 3, 8-11. Comprises notes on taro, yams, cassava, bread fruit and kumala (sweet potatoes).

Analyses of Some Indian Food Plants. By E. Yanovsky and R. M. Kingsbury. *J. Ass. Off. Agric. Chem., Wash.*, 1938, **21**, 648-665. Relates to the food plants of the Indians of North America.

Food Consumption Habits in the Far East. By H. Lindstedt. *Int. Rev. Agric.*, 1938, **29**, 399E-413E. Discusses general characteristics of the diet and the individual products consumed.

The Vitamin Content of Human Foods as Affected by Processes of Cooking and Canning. (With tables.) By M. A. B. Fixsen. *Nutr. Abstr. Rev.*, 1938, **8**, 281-295.

Lead in Food. By G. W. Monier-Williams. *Rep. No.* 88, *Publ. Hlth., Med. Subj., Lond.* Pp. 51, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 1s.

Beverages

Ueber Kakaofermentation. By O. von Lilienfeld-Toal. *Bull. Off. Int. Choc. Cacao, Brux.*, 1938, **8**, 331-356.

Contribution to the Knowledge of Cocoa Beans. By O. F. Kaden. *Gordian*, 1938, **44**, No. 1045, 11-14. Observations on the quality of cocoa beans with special reference to grading.

Third Annual Report of the Indian Coffee Cess Committee, Bangalore, for 1937-38. Pp. 33, 9¾ × 6½. (Bangalore: Indian Coffee Cess Committee, 1938.) Price As. 8.

The Culture of Coffee. By F. G. Galang. *Philipp. J. Agric.*, 1938, **9**, 211-221. Relates specially to conditions in the Philippines.

Recherches sur la Préparation du Café par Voie Humide. By R. Wilbaux. *Publ. No.* 21, *Sér. Tech., Inst. Nat. Étude Agron. Congo Belge.* Pp. 47, 9½ × 6¼. (Brussels: Institut National pour l'Étude Agronomique du Congo Belge, 1938.) Price 15 fr. Describes experiments on the wet fermentation of coffee, chiefly of the Robusta type.

Possibilités pour la Culture du Thé dans la Région du Kivu. By J. J. B. Deuss. *Bull. Agric. Congo Belge*, 1938, **29**, 636-650.

Tea Planting in Malaya. By B. G. A. Lowe. *Planter, Malaya*, 1938, **19**, 409-415.

Soil Erosion on Tea Estates and Some Suggestions for its Control. By W. C. Lester-Smith. *Trop. Agric., Ceylon*, 1938, **91**, 280-285.

The Fermentation Process in Tea Manufacture. I. The Role of Peroxidase. By E. A. H. Roberts and S. N. Sarma. *Biochem. J.*, 1938, **32**, 1819-1828.

Cereals

Grain Grading Primer. By W. P. Carroll and W. B. Combs. *Misc. Publ. No.* 325, *U.S. Dep. Agric.* Pp. 44, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Seed-disinfection Trials with Cereals. By I. D. Blair. *N.Z. J. Sci. Tech.*, 1938, **20**, 128A-132A.

Eelworm (*Heterodera schachtii* Schmidt) Disease of Cereals. Part II. By C. R. Millikan. *J. Dep. Agric. Vict.*, 1938, **36**, 507-520.

Control of Insects Attacking Grain in Farm Storage. By R. T. Cotton. *Frms'. Bull. No.* 1811, *U.S. Dep. Agric.* Pp. 14, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Due Piante Provvidenziali per le Regioni Tropicali. By M. E. Razeto. *Agricoltura Colon.*, 1938, **31**, 497-501. Deals with the cultivation and production of "Adley" (*Coix edulis*) as a substitute for wheat and "Totolquelite" (*Meibomia nicaraguensis*) for use as a fodder.

The Rothamsted Field Experiments on Barley, 1852-1937. Part II. Effects of Phosphatic and Potassic Fertilizers Deterioration under Continuous Cropping. By Sir E. J. Russell and D. J. Watson. *Emp. J. Exp. Agric.*, 1938, **6**, 293-314.

Mechanizing the Corn Harvest. By C. K. Shedd and E. V. Collins. *Frms'. Bull. No.* 1816, *U.S. Dep. Agric.* Pp. 12, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Production et Commerce du Riz dans le Monde. By P. Tissot. *Rev. Bot. Appl.*, 1938, **18**, 669-682.

World Rice Production and Trade. By F. J. Rossiter. *Foreign Agric.*, 1938, **2**, 455-482.

Le Riz. Origine et Histoire de sa Culture. By G. G. Gustchin. *Riz et Rizic.*, 1938, **12**, 61-96.

Paddy Manurial and Cultural Experiments at Paranthan Paddy Station. By W. R. C. Paul and A. W. R. Joachim. *Trop. Agric., Ceylon*, 1938, **91**, 135-143.

The Yield of Paddy in Ceylon. By M. Park. *Trop. Agric., Ceylon*, 1938, **91**, 165-168.

Le Possibilità di Coltivazione del Riso in Etiopia. By G. Sampietro. *G. Risicolt.*, 1938, **28**, 181-190, 201-206, 221-225. The possibilities of rice-growing in Ethiopia.

Padi Selection and Varietal Trials, 1937-38. By R. B. Jagoe. *Malay. Agric. J.*, 1938, **26**, 497-529.

Rice Culture in the Southern States. *Frms'. Bull. No.* 1808, *U.S. Dep. Agric.* Pp. 29, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Études sur le Riz Étuvé. By G. Stahel. *Riz et Rizic.*, 1938, **12**, 119-164. A study of parboiled rice with reference to its decortication and qualities.

The Effects of Increasing Quantities of Cattle Manure on Paddy. By A. W. R. Joachim, W. R. C. Paul and G. V. Wickremasekera. *Trop. Agric., Ceylon*, 1938, **91**, 144-155.

Recherches sur l'Influence de l'Irrigation Périodique sur le Rendement du Riz et sur ses Rapports avec la Destruction des Larves du Moustique Propagateur de la Malaria. By C. Katzaroff. *Riz et Rizic.*, 1938, **12**, 177-193. Experiments on the influence of periodical irrigation on the yield of rice and its effects on the destruction of the larvæ of the malaria-carrying mosquito.

Proceedings of the Conference of Commonwealth and State Ministers on Wheat held at Canberra, August 29, 1938. Pp. 8, 13 × 8. (Canberra: Commonwealth Government Printer, 1938.) Price 6*d.*

Production of Strong Wheat in Basutoland. By R. W. Thornton and L. F. Wacher. Pp. 42, 9½ × 6. (Maseru: Department of Agriculture, 1938.)

Correlations between Annual Precipitation and the Yield of Spring Wheat in the Great Plains. By J. S. Cole. *Tech. Bull. No.* 636, *U.S. Dep. Agric.* Pp. 40, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Emmer and Spelt. By J. H. Martin and C. E. Leighty. *Frms'. Bull. No.* 1429 (*Revised*), *U.S. Dep. Agric.* Pp. 12, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents. An account of the cultivation, etc., of these two kinds of wheat.

The Effect of Time and Rate of Application of Nitrogen Fertilizers on the Yield of Wheat. By A. H. Lewis, J. Procter and D. Trevains. *J. Agric. Sci.*, 1938, **28**, 618-629.

The Appearance of a New Physiologic Form of Stem Rust [of Wheat] in Kenya Colony. By R. J. Lathbury. *E. Afr. Agric. J.*, 1938, **4**, 183-185.

Reaction of Wheat, Barley and Rye Varieties to Stripe Rust in the Pacific North-West. By W. M. Bever. *Circ. No.* 501, *U.S. Dep. Agric.* Pp. 15, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Sugar

Thirty-eighth Annual Report of the Bureau of Sugar Experiment Stations, Queensland, for 1936-37. Pp. 58, 13 × 8½. (Brisbane: Government Printer, 1938.)

A Survey of the Yields of Sugar-cane in Jamaica, 1936-1937. Report by H. H. Croucher. *Bull. No.* 16 (*New Ser.*), *Dep. Sci. Agric. Jamaica.* Pp. 36, 9½ × 6. (Kingston, Jamaica : Government Printing Office, 1938.)

Eighth Annual Report of the Sugar-cane Research Station, Department of Agriculture, Mauritius, for the year 1937. Pp. 62, 9¾ × 6¼. (Port Louis : Department of Agriculture, 1938.)

Annual Report of the Sugar-cane Investigation Committee on Field Experiments on Sugar-cane in Trinidad. By P. E. Turner. Pp. 121, 8½ × 5½. (Trinidad : Sugar-cane Investigation Committee, 1938.)

Land Preparation for Sugar-cane. By J. A. Gibb. *Int. Sug. J.*, 1939, **41,** 14-17.

Deterioration in Cut Cane. *Int. Sug. J.*, 1938, **40,** 413.

A Study of Factors Influencing the Extraction of Juice from the Sugar-cane. By Ranji Narain and Azmat Singh. *Indian J. Agric. Sci.*, 1938, **8,** 699-717.

New Possibilities for the Utilisation of Sugar and its Derivatives. By G. Stampa. *Int. Rev. Agric.*, 1938, **29,** 361T-367T.

Observations on Sugar-cane Moth Borers (*Diatræa* spp.) in St. Lucia. III. The Introduction and Establishment of the Amazon Fly (*Metagonistylum minense* Townsend) and Control of *Diatræa saccharalis* Fabricius by means of this Parasite. Report on a Visit to St. Lucia, March-April 1938. By H. E. Box. Pp. 25, 12 × 7½. (Castries, St. Lucia : Government Printing Office, 1938.)

Pythium Root Rot of Sugar-cane. By R. D. Rands and E. Dopp. *Tech. Bull. No.* 666, *U.S. Dep. Agric.* Pp. 96, 9 × 6. (Washington, D.C. : Superintendent of Documents, Government Printing Office, 1938.) Price 15 cents.

Red Rot of Sugar-cane. By E. V. Abbott. *Tech. Bull. No.* 641, *U.S. Dep. Agric.* Pp. 96, 9 × 6. (Washington, D.C. : Superintendent of Documents, Government Printing Office, 1938.) Price 15 cents.

British Beet Sugar Industry. *Chem. and Drugg.*, 1938, **129,** 455-457. An account of the history of the beet sugar industry in the United Kingdom with an outline of the manufacturing processes for the sugar.

Sugar Beet : Manuring and Cultivation. By A. W. Ling and F. Rayns. *J. Minist. Agric.*, 1938, **45,** 806-809.

Beet Sugar Manufacture. By W. E. Callingham. *Food Manuf.*, 1938, **13,** 257-260.

Les Érablières et l'Industrie du Sucre d'Érable. By F. Scarone. *Agron. Colon.*, 1938, **27,** 106-115. Deals with the exploitation of maples in N. America and gives an account of the production of sap from the trees and its composition, and the manufacture of maple sugar.

Root Crops

Le Manioc. Sa Production et son Utilisation. By E. Francois. *Rev. Bot. Appl.*, 1938, **18,** 533-573, 682-707. Deals with the cultivation of cassava and the varieties grown, and gives an account of the preparation of cassava products and discusses their production in the French Colonies.

Le Manioc et son Utilisation à la Martinique. By D. Kervégant. *Bull. Agric. Martinique*, 1938, **7,** 60-73. An account of the cultivation of cassava in Martinique and the preparation of cassava flour.

Studies of the Mosaic Diseases of Cassava. By H. H. Storey and R. F. W. Nichols. *Ann. Appl. Biol.*, 1938, **25,** 790-806.

Manurial Requirements of Potatoes. By J. T. Ramsay. *J. Dep. Agric. Vict.*, 1938, **36,** 602-604, 620.

The Fight Against Potato Disease. By R. N. Salaman. *J. Minist. Agric.*, 1938, **45,** 881-889.

Sweet Potato Propagation and Transplanting Studies. By J. H. Beattie, V. R. Boswell and J. D. McCowan. *Circ. No.* 502, *U.S. Dep. Agric.* Pp. 16, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Effect of Potash on Grade, Shape and Yield of Certain Varieties of Sweet Potatoes grown in South Carolina. By V. R. Boswell, J. H. Beattie, and J. D. McCowan. *Circ. No.* 498, *U.S. Dep. Agric.* Pp. 24, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

A Comparative Study of Suitability for Drying Purposes in Forty Varieties of the Sweet Potato. By J. S. Caldwell, H. H. Moon and C. W. Culpepper. *Circ. No.* 499, *U.S. Dep. Agric.* Pp. 52, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

The Sweet Potato Leaf Beetle (*Typophorus viridicyaneus* Crotch). By L. W. Brannon. *Circ. No.* 495, *U.S. Dep. Agric.* Pp. 10, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Manufacture of Sweet Potato Starch in the United States. By H. S. Paine, F. H. Thurber, R. T. Balch and W. R. Richee. *Industr. Engng. Chem., Industr. Ed.*, 1938, **30**, 1331-1348.

Fruits

Fruit. A Summary of Figures of Production and Trade relating to Apples, Pears, Bananas, Citrus Fruit, Grapes, Wine, Raisins and Currants, and Canned Fruit. *Publication of the Imperial Economic Committee.* Pp. 88, 9¾ × 7¼. (London: H.M. Stationery Office, 1938.) Price 2*s.* 6*d.*

Progress of Fruit Cultivation in Tropical and Sub-tropical Countries: Its Importance in Countries of the Temperate Zone Also. By M. Calvino. *Int. Rev. Agric.*, 1938, **29**, 442T-452T.

Fourteenth Annual Report of the Commonwealth Dried Fruits Control Board for the year 1937-38, together with the Statement by the Minister for Commerce regarding the Operation of the Dried Fruits Export Control Act, 1924-1938. Pp. 18, 13 × 8. (Canberra: Commonwealth Government Printer, 1938.) Price 1*s.*

Annual Report of the Overseas Representative of the South African Co-operative Deciduous Fruit Exchange Limited, Cape Town, for the Season 1937-1938. Pp. 116, 9½ × 7¼. (London: South African Co-operative Deciduous Fruit Exchange, Ltd., 1938.)

Frost and Fruit-growing. By C. E. Cornford. *J. Minist. Agric.*, 1939, **45**, 981-991.

Factors Affecting the Setting of Fruits. By P. H. Thomas. *Tasm. J. Agric.*, 1938, **9**, 185-189.

Some Biological Aspects of the Storage of Fruits. By V. H. Blackman. *Sci. Progr., Lond.*, 1939, **33**, 417-434.

Freezing Methods Evaluated. By J. G. Woodroof. *Food Industr.*, 1938, **10**, 618-621, 659. Discusses the best ways of freezing fruits and vegetables as shown by a series of tests.

Fruit Tree Capsids. *Adv. Leafl. No.* 154, *Minist. Agric., Lond.* Pp. 4, 8½ × 5½. (London: H.M. Stationery Office, 1938.) Price 1*d.* Description, life history and method of control of capsid bugs.

Two New Winter Washes for Fruit Trees. By G. L. Hey. *J. Minist. Agric.*, 1938, **45**, 932-940. Discusses the results obtained from washes made from petroleum oil in which (*a*) an organic thiocyanate and (*b*) di-nitro-ortho-cresol were incorporated, respectively.

The Problem of Spray Residues on Orchard Fruit. By H. Shaw. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 65-66.

The Apple Leaf Jassid in South Australia. Part I. By H. K. Kemp. *J. Dep. Agric. S. Aust.*, 1938, **42**, 394-401. Discusses the origin, life history and damage done by this pest and indicates methods of control by spraying.

The Control of Mussel Scale (*Lepidosaphes ulmi* L.). By H. R. Powell. *J. Dep. Agric. W. Aust.*, 1938, **15**, 285-287. A common pest of the apple tree.

Disposal of Surplus Apples. Part I. Canning and Preserving Outlet. Part II. Cyder and Juice Fruit Prices. By J. F. Goaman. *Fruit-grower*, 1939, **85**, 47-48, 54, 79-80, 91. Discusses the problem of the utilisation of surplus apples in England.

Principles and Methods Involved in Dehydration of Apples. By C. C. Eidt. *Publ. No.* 625, *Dep. Agric. Canada.* Pp. 36, 9¾ × 6½. (Ottawa : Department of Agriculture, 1938.)

The Cultivation of Bananas. By B. E. V. Parham. *Agric. J. Fiji*, 1938, No. 3, 6-7.

Banana Varieties in Jamaica. By L. N. H. Larter. *J. Jam. Agric. Soc.*, 1938, **42**, 460-468.

Banana Diseases. XII. Diseases of the Banana in Haiti, with Special Reference to a Condition Described as " Plant Failure." By C. W. Wardlaw. *Trop. Agric., Trin.*, 1938, **15**, 276-282.

Banana Leaf Spot. Summer Treatment Gives Promising Results. By C. J. Magee and E. P. Foster. *Agric. Gaz. N.S.W.*, 1938, **49**, 662-664.

" Il Pane " di Fecola di Banano Abissino. By S. Copertini. *Agricoltura Colon.*, 1938, **31**, 444-446. Notes on bread made from Ethiopian banana flour.

Citrus Culture in the Dry Zone. Duty of Water and Irrigation Practice. By R. Kahawita. *Trop. Agric., Ceylon*, 1938, **91**, 266-279.

Citrus Cultivation and Citrus Entomology in Malta. By F. S. Bodenheimer. *Hadar*, 1938, **11**, 290-294.

Citrus Fruit Production and Trade in Palestine. By A. Pascual. *Int. Rev. Agric.*, 1938, **29**, 462T-469T.

Results of Citrus Hybridisation in the Philippines. By J. P. Torres. *Philipp. J. Agric.*, 1938, **9**, 161-176.

Some Effects of Green Manuring on Citrus Trees and on the Soil. By E. S. West and A. Howard. *Bull. No.* 120, *Coun. Sci Industr. Res. Aust.* Pp. 36 + 9 plates, 9½ × 6. (Melbourne : Government Printer, 1938.)

The Reaction of the Orange Fruit to the Autumn Attack of the Mediterranean Fruit Fly and its Economic Status. By E. Rivnay, M. Nadel and F. Littaver. *Hadar*, 1938, **11**, 317-323.

Citrus Pests : Part 5. Scale Insects. By W. Cottier. *N.Z. J. Agric.*, 1938, **57**, 429-432.

Red Scale of Citrus in South Australia. By A. G. Strickland. *J. Dep. Agric. S. Aust.*, 1938, **42**, 387-393. An account of the life history of the pest and methods of control.

" Mottle-leaf " of Citrus in New Zealand. By G. G. Taylor and M. M. Burns. *N.Z. J. Sci. Tech.*, 1938, **20**, 115A-119A.

The Mechanical Treatment of Citrus Fruit. A Review of Experience in this Field. *Hadar*, 1938, **11**, 335-336.

Preserved Citrus Peels. By F. K. Donovan. *Flavours*, 1938, **1**, 26-33.

Nuovi Indirizzi in Limonicoltura. By G. Ajon. *Riv. Ital. Essenze*, 1938, **20**, 310-313, 341-346. Discusses new tendencies in the cultivation of lemons.

The Selection and Propagation of Limes. By G. K. Argles. *J. Jam. Agric. Soc.*, 1938, **42**, 471-478.

Orange Cultivation and Production in Spain. By A. Pascual. *Int. Rev. Agric.*, 1938, **29**, 339T-351T.

The Orange Industry: An Economic Study. By J. M. Thompson. *Bull. No.* 622, *Calif. Agric. Exp. Sta.* Pp. 85, 9 × 6. (Berkeley, California: Agricultural Experiment Station, 1938.) Is mainly concerned with the orange industry in the U.S.A., but gives brief accounts of production in other countries.

The Clementine in Italy. By L. Zanotti. *Hadar*, 1938, **11**, 296-298. A botanical description and particulars of the characteristics of this fruit which is a hybrid between the common mandarine and the Chinese bitter orange.

Inflorescence Blight of the Date Palm. By J. G. Brown. *J. Agric. Res.*, 1938, **57**, 313-318.

Viticulture in California. By F. C. Hugo. *Frmg. S. Afr.*, 1938, **13**, 427-428, 449.

Vine Diseases and Pests in the Murray Irrigation Area. By A. G. Strickland. *J. Dep. Agric. S. Aust.*, 1938, **42**, 128-134. Methods of control are indicated.

Euplectrus agaristæ Craw., a Parasite of the Grape Vine Moth (*Phalænoides glycine* Lew.). By N. S. Noble. *Sci. Bull. No.* 63, *Dep. Agric. N.S.W.* Pp. 27, 9½ × 6. (Sydney, N.S.W.: Government Printer, 1938.)

Further Studies on the Control of *Botrytis* Rot in Grapes. By S. J. du Plessis. *Sci. Bull. No.* 166, *Dep. Agric. Un. S. Afr.* Pp. 32, 9½ × 6. (Pretoria: Government Printer, 1938.) Price 3*d*.

The Occurrence of the Dead-arm Disease of Vines in South Africa. By S. J. du Plessis. *Sci. Bull. No.* 175, *Dep. Agric. Un. S. Afr.* Pp. 12, 9½ × 6. (Pretoria: Government Printer, 1938.) Price 3*d*.

Acclimatisation of the Mango in Palestine. By C. Oppenheimer. *Hadar*, 1938, **11**, 331-334.

Bottling Olives. *Food Industr. Rev.*, 1939, **9**, 16-18. Deals with the selection of the olives, their processing and packing procedure.

The Control of Peach Mildew. By Amin Fikry. *Bull. No.* 183, *Tech. and Sci. Serv. Minist. Agric. Egypt.* Pp. 14 + 7 plates, 10½ × 7. (Bulâq, Cairo: Publications Office, Government Press, 1937.) Price P.T. 3.

Codling Moth and Williams Pears. Goulburn Valley Investigations. By L. W. Miller. *J. Dep. Agric. Vict.*, 1938, **36**, 545-561.

Pineapple-canning in Malaya. By W. J. B. Johnson. *Food*, 1938, **8**, 9-14. An authoritative account by the Canning Research Officer, Department of Agriculture, S.S. and F.M.S.

The Utilisation of Surplus Plums. By W. V. Cruess. *Fruit Prod. J.*, 1938, **18**, 72-74, 89, 91, 101-105. Describes methods of making various plum products.

The Strawberry Problem. By R. Wellington. *J. Minist. Agric.*, 1939, **45**, 1008-1018.

Spacing and Manurial Experiments with Tomatoes. Part I. By W. R. C. Paul and E. S. Jayasundera. Part II. By W. R. C. Paul and A. W. R. Joachim. *Trop. Agric., Ceylon*, 1938, **91**, 208-216.

Tomato Seed Production. A Commercial Proposition for New South Wales. By J. Douglass. *Agric. Gaz. N.S.W.*, 1938, **49**, 597-599. Discusses methods for separating and cleaning the seed and dipping for disease control.

Tomatoes for Canning and Manufacturing. By J. H. Beattie. *Frms'. Bull. No.* 1233 (*Revised*), *U.S. Dep. Agric.* Pp. 18, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Caterpillars Attacking Tomatoes. By A. E. Michelbacher and E. O. Essig. *Bull. No.* 625, *Calif. Agric. Exp. Sta.* Pp. 42, 9 × 6. (Berkeley, California: Agricultural Experiment College, 1938.)

Bacterial Canker of Tomatoes. By W. D. Reid. *N.Z. J. Sci.*

Tech., 1938, **20,** 69A-74A. Discusses the characters of the disease, methods of transmission, and control measures.

Potentiality of the Cashew Nut Industry in Fiji. By B. L. Field. *Agric. J. Fiji*, 1938, No. 3, 13-15.

Vino de Marañon. *Rev. Agric., Habana*, 1938, **21,** 27-31. Describes the preparation of cashew wine.

A Survey of the Investigations on the Propagation and Testing of Walnuts at the East Malling Research Station. By A. W. Witt. *Quart. J. For.*, 1939, **33,** 6-13. Gives a list of the varieties recommended for planting in Britain and also varieties specially grown for timber.

Spices

Flavours in the Spice Industry. *Flavours*, 1938, **1,** 57-63.

Manurial Experiments with Chillies. By A. W. R. Joachim and W. R. C. Paul. *Trop. Agric., Ceylon*, 1938, **91,** 217-230.

The Nature of Chilli Leaf-curl. By M. Park and M. Fernando. *Trop. Agric., Ceylon*, 1938, **91,** 263-265.

The Market for Cinnamon. *Ceylon Tr. J.*, 1938, **3,** 416-417. Discusses the position of the trade in cinnamon bark and oil in Ceylon.

Preparation of Turmeric for the Market. A New Polishing Machine. By N. G. Charley. *Agric. Live-Stk. India*, 1938, **8,** 695-696.

Vegetables

Marketing Commercial Cabbage. By R. L. Spangler. *Tech. Bull. No.* 646, *U.S. Dep. Agric.* Pp. 126, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 15 cents.

The Control of Cabbage Root Fly, *Delia* (*Hylemia*) *brassicæ* Bouché. By D. W. Wright. *J. Minist. Agric.*, 1938, **45,** 812-820.

Investigations into the Environment and Nutrition of the Cultivated Mushroom (*Psalliota campestris*). II. The Effect of Calcium and Phosphate on Growth and Productivity. By N. H. Pizer and A. J. Thompson. *J. Agric. Sci.*, 1938, **28,** 604-617.

Descriptions of Types of Principal American Varieties of Spinach. By R. Magruder, V. R. Boswell, G. W. Scott, P. Work and L. R. Hawthorn. *Misc. Publ. No.* 316, *U.S. Dep. Agric.* Pp. 60, 11¼ × 9. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 25 cents.

Fodders and Forage Plants

Intensive Grazing on Kenya Veld. The Effect of Rotational Grazing and Fertilisers on Carrying Capacity and Milk Yields over a Five-year Period. By T. D. Hall and B. Allen. *E. Afr. Agric. J.*, 1938, **4,** 165-182.

Pasture Research in South Africa. Progress Report No. 1. Pp. 162 + 19 plates, 9½ × 6. (Pretoria: Department of Agriculture, 1938.)

Dried Grass Concentrate in the Tropics. A Preliminary Investigation into the Utility of Artificial Grass Driers for Fodder Crops in Trinidad. By D. D. Paterson. *Trop. Agric., Trin.*, 1938, **15,** 267-270.

The Carotenoid Content of Some Pasture Plants, and the Effects of Low-temperature Drying. By F. E. Moon. *J. Soc. Chem. Ind., Lond.*, 1938, **57,** 455-457.

The Carotene-Xanthophyll Ratio in Fresh and Dried Grass. By F. E. Moon. *J. Soc. Chem. Ind., Lond.*, 1938, **57,** 457-460.

The Carotene Content of Market Hays and Corn Silage. By H. G. Wiseman, E. A. Kane, L. A. Shinn and C. A. Cary. *J. Agric. Res.*, 1938, **57,** 635-669.

Further Experiments with Cultivated Tropical Fodder Crops. By D. D. Paterson. *Emp. J. Exp. Agric.*, 1938, **6**, 323-340. Discusses the results of experiments with Guatemala grass (*Tripsacum laxum*), Para grass (*Panicum barbinode*), and a variety of sugar-cane (*Saccharum sinense* Var. Co. 213) carried out in Trinidad.

The Digestibility and Nutritive Value of Karroo Pasture Plants. IX. Knietjiesgras (*Eragrostis lehmanniana* Nees). By J. P. Botha. *Frmg. S. Afr.*, 1938, **13**, 431.

Reed Canary Grass (*Phalaris arundinacea* L.). By H. A. Schoth. *Frms'. Bull. No.* 1602 (*Revised*), *U.S. Dep. Agric.* Pp. 12, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

The Composition and Apparent Digestibility of Pea Silage, Sun Cured Pea Vines and Artificially Dried Pea Vines. By R. E. Hodgson and J. C. Knott. *Bull. No.* 364, *Wash. St. Agric. Exp. Sta.* Pp. 12, 9 × 6. (Pullman, Washington: Agricultural Experiment Station, 1938.)

Feeding Cottonseed Products to Livestock. By E. W. Sheets and E. H. Thompson. *Frms'. Bull. No.* 1179 (*Revised*), *U.S. Dep. Agric.* Pp. 14, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Wheat. A Cheap and Valuable Fodder. By A. C. T. Hewitt. *J. Dep. Agric. Vict.*, 1938, **36**, 533-535.

Silage, Silos, and Silage Crops. By I. J. Smuts. *Bull. No.* 181, *Dep. Agric. Un. S. Afr.* Pp. 51, 9½ × 6. (Pretoria: Government Printer, 1938.) Price 6*d.*

New Methods of Ensilage. By H. J. Hopfen. *Int. Rev. Agric.*, 1938, **29**, 472T-475T.

The Conservation of Green Fodders for the Dry-season Feeding of Stock. By M. H. French. *E. Afr. Agric. J.*, 1938, **4**, 206-210.

Green Fodder for Pigs. By C. Crowther. *J. Minist. Agric.*, 1938, **45**, 874-880.

Oils and Oil Seeds

Contribution à l'Étude des Huiles Siccatives d'Aleurites Utilisées dans l'Industrie. By P. Lévy. Pp. 62, 10½ × 8¼. (Levallois-Perret: Société Industrielle d' Imprimerie, 1938.) Price frs. 25. A study of the properties of the oils from the seeds of *Aleurites montana* and *A. fordii.*

O Babaçú na Economia Nacional. By A. D. Gonsalves. *Publication of the Ministry of Agriculture, Brazil.* Pp. 86, 10½ × 7. (Rio de Janeiro: Diretoria de Estatistica da Produçao, 1938.)

La Noix de Babassù (*Attalea funifera*). By F. Scarone. *Agron. Colon.*, 1938, **27**, 78-82.

The Fatty Acids and Glycerides of Solid Seed Fats. VI. Borneo Tallow. By W. J. Bushell and T. P. Hilditch. *J. Soc. Chem. Ind., Lond.*, 1938, **57**, 447-449.

Note on the Cultivation of the Castor Oil Plant on the Sand Dunes of Mogadon and Agadir. By P. Boulhol. *Publication of the Imperial Forestry Institute, Oxford.* Pp. 3, 10½ × 8½. (Oxford: Imperial Forestry Institute, 1938.) Consists of a translation of a note prepared by the author who is a member of the Forest Service of Morocco.

A Study of Coconut Palm Yields and Seed Selection in Zanzibar. By R. Johns. *E. Afr. Agric. J.*, 1938, **4**, 186-194.

Coconut Improvement by Seed Selection and Plant Breeding. By R. E. P. Dwyer. *N. Guinea Agric. Gaz.*, 1938, **4**, 24-102.

Javan Parasite of the Coconut Leaf-miner. By R. J. Lever. *Agric. J., Fiji*, 1938, **9**, 12-14. Notes on attempts to control *Promecotheca nuciferæ* by *Pleurotropis* sp.

Measures for Control of the Coconut Tree-hopper (*Sexava* spp.). By J. L. Froggatt. *N. Guinea Agric. Gaz.*, 1938, **4**, 3-6.

Coconut Wilt in Essequibo and Pomeroon Districts, British Guiana. By D. W. Duthie. *Agric. J. Brit. Guiana*, 1938, **9**, 147-162.

Preliminary Biochemical Studies on Effects of Certain Environmental Factors on Development and Composition of the Peanut. By S. L. Jodidi. *J. Agric. Res.*, 1938, **57**, 301-311.

Nouvelle Contribution à l'Étude de la Lutte contre la " Rosette " de l'Arachide. By G. Bouriquet. *Bull. Écon. Madagascar*, 1938, No. 13, 55-58.

A Study of Indian Mustard and Rape Seeds and their Oils. By D. Y. Athawale, J. A. H. Duke and P. N. Mathur. *Bull. No.* 13, *Indian Industr. Res.* Pp. 20, 10 × 7. (Delhi : Manager of Publications, 1938.) Price As. 14.

A Note on a Uniformity Trial with Oil Palms. By C. C. Webster. *Trop. Agric., Trin.*, 1939, **16**, 15-19. Describes a trial carried out in Southern Nigeria.

Les Huiles d'Olive de Tunisie et la Réaction de Fitelson pour la Recherche de l'Huile de Thé. By R. Marcille. *Bull. Direct. Affaires Écon., Tunis*, 1938, **42**, 353-357. A study of Fitelson's method for the detection of tea-seed oil in olive oil applied to Tunisian olive oil.

A Further Experiment on Soya Inoculation in Ceylon. By M. Park and M. Fernando. *Trop. Agric., Ceylon*, 1938, **91**, 201-207.

The German Soybean Problem. By W. Riede. *Herb. Rev.*, 1938, **6**, 245-257. An account of the breeding and cultivation of soybeans in Germany and a discussion on the prospects for the crop.

De Situatie van Kedelee (Sojaboonen) in Nederlandsch-Indië en de Beoordeeling van het Product in Nederland. *Ber. No.* 132, *HandMus. Kolon. Inst. Amst.* Pp. 18, $8\frac{3}{4} \times 5\frac{3}{4}$. (Amsterdam : Koloniaal Instituut, 1938.) The soybean situation in the Netherlands East Indies and the opinion on the product in the Netherlands. Summary in English. Reprinted from *Ind. Mercuur*, 1938, **61**, 685-686.

Soya Beans in New Zealand. Question of Economic Value Examined. By M. A. Black. *N.Z. J. Agric.*, 1938, **57**, 293-295.

Soybeans for the Table. By E. F. Whiteman and E. K. Keyt. *Leafl. No.* 166, *U.S. Dep. Agric.* Pp. 6, 9 × 6. (Washington, D.C. : Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents. Recipes for soybeans and soybean products.

A Study of Protein Extract from Soybeans with Reference to its Use in Food. By S. Woodruff, E. Chambers and H. Klaas. *J. Agric. Res.*, 1938, **57**, 737-746.

Protein Plastics from Soybean Products. By G. H. Brother and L. L. McKinney. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 84-87.

Development of Soybean Protein as a Possible Base for Plastic Material. By G. H. Brother and L. L. McKinney. *Brit. Plast. Mould. Prod. Tr.*, 1938, **10**, 248-251.

Protein Plastics from Soybean Products. Action of Hardening or Tanning Agents on Protein Material. By G. H. Brother and L. L. McKinney. *Industr. Engng. Chem., Industr. Ed.*, 1938, **30**, 1236-1240.

The Sunflower (*Helianthus annuus*). By L. A. Elmer. *E. Afr. Agric. J.*, 1938, **4**, 218-225. An account of the growing of sunflowers for seed production and as a green manure crop, and a discussion on the uses of sunflowers with special reference to East Africa.

Haifischfang und Haifischverwertung, mit Besonderer Berücksichtigung der Leberöle. By W. Schnakenbeck. *Fette u. Seifen*, 1938, **45**, 450-456. Deals with the catching of sharks and their utilisation with special reference to the preparation of the liver oil.

Essential Oils

Annual Report by Schimmel & Co. on Essential Oils, Synthetic Perfumes, etc., 1938 Edition. Pp. 177, 8¾ × 6. (Miltitz bei Leipzig: Schimmel & Co., 1938.)

East African Essential Oils. By A. C. Stirling. *Soap Perf. Cosmetics*, 1938, **11**, 1104-1106.

Les Huiles Essentielles Russes. By E. Gorokhoff. *Parfum. Mod.*, 1938, **32**, 439-447. Notes on the various essential oils produced in Russia.

Note on the Exudation of *Araucaria bidwilli*. By A. J. Birch. *J. Roy. Soc. N.S.W.*, 1937-38, **71**, 259-260. Deals with the examination of the material for essential oils and gum.

Cypress Oil from Kenya. By J. Sfiras. *Recherches, Paris*, 1938, **2**, 17-23, 111-119. A study of the oil from the Kenya cypress, probably *Cupressus lusitanica*, and a comparison of its properties with oils of other species of *Cupressus*.

Eucalyptus Oils. By H. Silman. *Mfg. Chem.*, 1938, **9**, 352-353, 390-392. Discusses the various eucalyptus oils in detail and their constituents and describes the method of their extraction and their uses.

The α-Phellandrene Fraction of Eucalyptus Oils. By A. J. Birch. *J. Roy. Soc., N.S.W.*, 1937-38, **71**, 261-266. Describes the examination of the α-phellandrene fractions of *E. dives*, *E. radiator*, *E. risdoni* and *E. amygdalina*.

L'Olio di "Longoza." *Riv. Ital. Essenze*, 1938, **20**, 350-351. Deals with the properties, characteristics, etc., of the essential oil of the flowers of *Hedychium flavum*.

Karo-Karoundé of French Guinea. By S. Sabètay, L. Palfray and L. Trabaud. *Perfum. Essent. Oil Rec.*, 1938, **29**, 344-347. An account of the extraction of the essential oil from this shrub (*Leptactinia* sp.) and of the characteristics of the oil.

Ocimum canum Oil of North India. By Jitendra Nath Rakshit. *Perfum. Essent. Oil Rec.*, 1938, **29**, 402. Gives particulars of the characteristics and composition of the oil obtained by the steam distillation of mature plants.

Synthetic Peppermint Oil. *Perfum. Essent. Oil Rec.*, 1938, **29**, 381-382.

The Influence on Host Plants on Sandal and on Spike Disease. By M. G. Venkata Rao. *Indian For.*, 1938, **64**, 656-669.

La Badiane au Tonkin. *Bull. Écon. Indochine*, 1938, **41**, 966-974. Deals with the cultivation and production of star anise (*Illicium verum*) and with the preparation of the essential oil.

The Utilisation of Pulp-mill By-products with Special Reference to Vanillin Manufacture. By G. H. Tomlinson. *J. Soc. Chem. Ind., Lond.*, 1938, **57**, 1047-1049.

Fibres

Annual Review, 1938, by Wigglesworth and Co., Ltd. Pp. 23, 9½ × 7½. (London: Wigglesworth and Co., Ltd., 1939.) A review of the position of the fibre market.

The Rot-proofing of Textiles. By S. G. Barker. *J. Soc. Chem. Ind., Lond.*, 1938, **57**, 1222-1229.

A Survey of Abaca Production in Davao, South Mindanao, Philippine Islands. By J. Fyfe. *Cord Age*, 1939, **32**, 16-17.

Vascular Disease of Abacá (Manila Hemp) in Davao. Progress Report No. 1. By M. R. Calinisan. *Philipp. J. Agric.*, 1938, **9**, 153-157.

Het "Kapok-en Beddegoedbesluit" van de Nederlandsche Warenwet. By W. Spoon. *Ber. No.* 131, *HandMus. Kolon. Inst. Amst.*

Pp. 8, 8¾ × 5¾. (Amsterdam : Koloniaal Instituut, 1938.) Price f. 0.25. Discusses the legal measures recently issued in Holland regarding kapok and its use as a stuffing material. Reprinted from *Ind. Mercuur*, 1938, **61**, 661.

Le Sisal et ses Fibres. (Aperçu des Recherches Entreprises en Angleterre et dans les Colonies Anglaises de l'Est-Africain.) By A. Hacquart. *Bull. Agric. Congo Belge*, 1938, **29**, 507-533.

The World Silk Situation. By M. Costa. *Int. Rev. Agric.*, 1938, **29**, 1044S-1053S. An outline of the 1938 sericultural season in different producing countries.

Paper-making Materials

United States Pulp and Paper Industry. By J. D. Studley. *Bull. No.* 182, *Tr. Prom. Ser., U.S. Dep. Comm.* Pp. 99, 9 × 6. (Washington, D.C. : Superintendent of Documents, Government Printing Office, 1938.) Price 15 cents.

Utilisation en Papeterie des Bois de l'Afrique Tropicale Française. By P. Goldsmid. Pp. 159, 9½ × 6. (Grenoble : La Université, 1938.) A thesis on the utilisation for paper-making of woods of French Tropical Africa.

The Cultivation of Baib. By M. D. Chaturdevi. *Indian For.*, 1938, **64**, 709-713. Baib is a perennial grass (*Pollindium binatum*) used mainly for paper-making.

Laboratory Experiments and Results in Developing Paper and Paper Parchment from Cocoa Husks. *Gordian*, 1939, **44**, 12-13.

A Study of the Pulping Properties of Three Trees of *Eucalyptus sieberiana* Using the Sulphate Process. By J. C. Cavanagh, H. E. Dadswell, A. W. Mackney and T. M. Reynolds. *Pamphl. No.* 86, *Coun. Sci. Industr. Res. Aust.* Pp. 35, 9½ × 6. (Melbourne : Government Printer, 1938.)

Sulphite Pulps from the Top, Middle and Butt Logs of Western Hemlock of Four Growth Types. By J. N. McGovern and G. H. Chidester. *Pap. Tr. J.*, 1938, No. 23, 37-39.

Rubber

Proceedings of the Rubber Technology Conference held under the auspices of the Institution of the Rubber Industry, May, 1938. Pp. 1137, 9½ × 7. (London : Institution of the Rubber Industry, 1938.) Contains over a hundred papers presented at the Conference which cover almost every phase of rubber technology from the physiology of latex-yielding plants to the marketing of manufactured rubber goods.

Enkele Gegevens over den Invoer en de Eerste Uitbreiding van de Heveacultuur in Belgisch-Congo. By A. Ringoet. *Bull. Agric. Congo Belge*, 1938, **29**, 403-417. An account of the introduction of Hevea into the Belgian Congo and the extension of its cultivation.

Report on the Working of Rubber Regulation in Malaya during 1937. By G. M. Kidd. Pp. 35, 9½ × 6. (Kuala Lumpur : Government Printer, 1938.) Price $1.

Methods of Reclaiming Rubber Employed during the Past Hundred Years. By P. Alexander. *Waste Tr. World*, 1938, **53**, No. 25, 15-18.

The Uses and Possibilities of Rubber in Agriculture. By A. Hay. *Bull. No.* 8, *Rubb. and Agric. Ser., Brit. Rubb. Publ. Assoc.* Pp. 25, 8½ × 5½. (London : British Rubber Publicity Association, 1938.)

Tobacco

The Effect of Transplanting Pricked and Unpricked Tobacco Seedlings of Different Ages upon Growth and Yield. By D. B. Paguirigan, F. de Peralta and O. M. Casupang. *Philipp. J. Agric.*, 1938, **9**, 177-200.

Aromatic Cigarette Leaf Tobacco Culture in the Philippines. By D. B. Paguirigan and J. C. Ramos. *Philipp. J. Agric.*, 1938, **9**, 203-207.

Symptoms on Field-grown Tobacco Characteristic of the Deficient Supply of Each of Several Essential Chemical Elements. By J. E. McMurtrey. *Tech. Bull. No.* 612, *U.S. Dep. Agric.* Pp. 31, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Reconditioning Tobacco. By C. Lowe. *N.Z. J. Agric.*, 1938, **57**, 329-331.

Control of the Blue Mold (Downy Mildew) Disease of Tobacco by Spraying. By E. E. Clayton, J. G. Gaines, T. E. Smith, W. M. Lunn and K. J. Shaw. *Tech. Bull. No.* 650, *U.S. Dep. Agric.* Pp. 22, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Rosette Disease of Tobacco. Field Observations and Suggestions for Control. By G. M. Wickens. *Rhod. Agric. J.*, 1938, **35**, 842-849.

Drugs

Some Aspects of the Control of *Koleroga* or *Mahali* of the Areca Palm. By K. M. Thomas. *Madras Agric. J.*, 1938, **26**, 434-438.

Note sur les Essais de Culture des Quinquinas au Cameroun. By R. Coste. *Ann. Agric. Afrique Occidental*, 1938, **2**, 3-11. A report presented to the Seventh International Congress of Tropical and Sub-tropical Agriculture, 1937.

An Improved Method for the Determination of Total Alkaloids in Cinchona Bark. By N. L. Allport and D. Friend. *Qrtly. J. Pharm.*, 1938, **11**, 450-459.

Ephedrine and Ma Huang. By K. K. Chen. *Chem. and Drugg.*, 1938, **129**, 585-588. Discusses the botany, physical and chemical properties of ephedrine, its pharmacological action and clinical uses, and mentions synthetic ephedrine products.

Commerce of Ephedra and its Alkaloids. *Chem. and Drugg.*, 1938, **129**, 596.

A Noz de Kola no Brasil. Contribuicão ao Estudo Quimico das Kolas. By R. D. de G. Paula. Pp. 48, 9 × 6½. (Rio de Janeiro: Instituto Nacional de Tecnologia, 1938.) An account of kola nuts in Brazil and a chemical study of the nuts.

The Enzyme Papain and its Value in the Preparation of Some Pharmaceutical Products. By A. F. Watson, R. A. Taggart and H. F. Mannion. *Qrtly. J. Pharm.*, 1938, **11**, 391-400.

Miscellaneous Agricultural Products

Brasilianische Palmen als Nutzpflanzen. By M. Burret. *Tropenpflanzer*, 1938, **41**, 477-502. An account of the palms of Brazil with particulars of the various products yielded.

The Seed Husk of *Plantago ovata* in Printing and Finishing. By S. R. Ramachandran and K. Venkataraman. *J. Soc. Dy. Col., Bradford*, 1938, **54**, 462-464.

Spray Drying. By B. B. Fogler and R. V. Kleinschmidt. *Industr. Engng. Chem., Industr. Ed.*, 1938, **30**, 1372-1384. A study of the spray drying process and its advantages.

Some Aspects of the Viscose Industry. By G. S. Heaven. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 66-69. Notes on the viscose process and its application to film production.

Livestock and Animal Products

Report on the Civil Veterinary Department, Burma, for the year ending March 31, 1938. Pp. 40, 9¾ × 6¼. (Rangoon: Superintendent, Government Printing and Stationery, 1938.) Price Rs. 2.

Report on the Department of Animal Health, Gold Coast Colony, for the year 1937-38. Pp. 30, 13 × 8. (Accra: Publications Branch, Government Printing Department, 1938.) Price 2*s*.

Report on the Veterinary Departments, Malaya, for the year 1937. Pp. 104, 9½ × 6. (Kuala Lumpur: Government Printer, 1938.) Price $1.

Annual Report of the Veterinary Department, Northern Rhodesia, for the year 1937. Pp. 70, 13½ × 8¼. (Lusaka: Government Printer, 1938.) Price 2*s*. 6*d*.

Annual Report of the Department of Veterinary Science and Animal Husbandry, Tanganyika Territory, for 1937. Pp. 158, 13 × 8. (Dar es Salaam: Government Printer, 1938.) Price 5*s*.

British Breeds of Live Stock. *Bull. No.* 86, *Minist. Agric., Lond.* Pp. 152, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 4*s*. 6*d*.

The Mineral Factor in Animal Health. By F. E. Corrie. *Mfg. Chem.*, 1938, **9**, 377-380.

Some Diseases of Farm Animals. *Bull. No.* 1 (*8th Ed.*), *Minist. Agric., Lond.* Pp. 154, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 2*s*.

Parasitic Diseases of Farm Animals. By E. L. Taylor. *Emp. J. Exp. Agric.*, 1938, **6**, 377-384.

Foot and Mouth Disease. By J. R. Mohler. *Frms'. Bull. No.* 666 (*Revised*), *U.S. Dep. Agric.* Pp. 17, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Bovine Contagious Abortion. *Bull. No.* 114, *Minist. Agric., Lond.* Pp. 15, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 4*d*.

Meat. A Summary of Figures of Production and Trade relating to Beef, Mutton and Lamb, Bacon and Hams, Pork, Cattle, Sheep, Pigs and Canned Meat. *Publication of the Imperial Economic Committee.* Pp. 96, 9¾ × 7¼. (London: H.M. Stationery Office, 1938.) Price 2*s*. 6*d*.

Home Preservation of Meats, Poultry and Soup. By E. L. Elliot. *Publ. No.* 628, *Dep. Agric. Canada.* Pp. 6, 9½ × 6½. (Ottawa: Department of Agriculture, 1938.)

Report of the Chief of the Bureau of Dairy Industry, United States Department of Agriculture, for the year ended June 30, 1938. Pp. 37, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Dairy Produce. A Summary of Figures of Production and Trade relating to Butter, Cheese, Preserved Milk, Casein, Eggs and Egg Products. *Publication of the Imperial Economic Committee.* Pp. 83, 9¾ × 7¼. (London: H.M. Stationery Office, 1938.) Price 2*s*. 6*d*.

Farm Butter Making. *Rhod. Agric. J.*, 1938, **35**, 941-971.

Experiments on the Manufacture of Casein under Indian Conditions. By S. Annaswamy and Dwijendra Lal Paul. *Agric. Live-Stk. India*, 1938, **8**, 643-652.

Das Eingeborenenschaf und die Akklimatisation von Cotentinschafen in Westkamerun (Bamum und Bamileke). By H. Golf. *Tropenpflanzer*, 1938, **41**, 546-555. Discusses the native sheep and the acclimatisation of Cotenin sheep in the West Cameroons.

Karakul Sheep. By C. G. Potts. *Frms'. Bull. No.* 1632, *U.S. Dep. Agric.* Pp. 12, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Pork on the Farm. Killing, Curing and Canning. By K. F. Warner. *Frms'. Bull. No.* 1186, *U.S. Dep. Agric.* Pp. 37, 9 × 6. (Washington, D.C.: Superintendent of Document, Government Printing Office, 1938.) Price 5 cents.

The Care and Feeding of Chickens. By G. D. Shaw. *J. Dep. Agric. W. Aust.*, 1938, **15**, 306-316.

Feeding Chickens. By H. J. Almquist, T. H. Jukes and W. E. Newlon. *Circ. No.* 108, *Calif. Agric. Ext. Serv.* Pp. 38, 9 × 6. (Berkeley, California : College of Agriculture, 1938.)

Breeding for Egg Production. By L. W. Taylor and I. M. Lerner. *Bull. No.* 626, *Calif. Agric. Exp. Sta.* Pp. 48, 9 × 6. (Berkeley, California : College of Agriculture, 1938.)

The Cold Storage and Gas Storage of Eggs. By T. Moran. *Leafl. No.* 8, *Food Invest. Bd.* Pp. 9, 9½ × 6. (London : Department of Scientific and Industrial Research, 1939.)

Turkeys as a Profitable Sideline on the Farm. By E. F. Lombard. *Bull. No.* 183, *Dep. Agric. Un. S. Afr.* Pp. 27, 9 × 6. (Pretoria : Government Printer, 1938.) Price 3*d.*

Report on Sea Fisheries for the year 1937. *Publication of the Ministry of Agriculture and Fisheries.* Pp. 88, 9½ × 6. (London : H.M. Stationery Office, 1938.) Price 1*s.* 6*d.* The report deals mainly with the sea fisheries of England and Wales.

Report of the Committee on the Control and Development of Fishing in Kenya. Pp. 80 + map, 10 × 6¼. (Nairobi : Government Printer, 1938.) Price 2*s.* Deals with river fishing in the Colony.

Approved Methods of Handling Codfish for Salting and Drying. By W. F. Hampton. *Serv. Bull. No.* 9 (*Fisheries*), *Dep. Nat. Resources, Newfdld.* Pp. 23, 9 × 6. (St. John's : King's Printer, 1938.) Contains appendices on (1) fish drying and (2) the importance of temperature in fish drying.

The Dogfish and How It Can be Used. By W. F. Hampton. *Serv. Bull. No.* 5 (*Fisheries*), *Dep. Nat. Resources, Newfdld.* Pp. 6, 8¾ × 6. (St. John's : King's Printer, 1938.)

Trout and Their Conservation. By N. Frost. *Serv. Bull. No.* 6 (*Fisheries*), *Dep. Nat. Resources, Newfdld.* Pp. 16, 8¾ × 6. (St. John's : King's Printer, 1938.)

Some Bee Plants of Ceylon. By A. W. Kannangara. *Trop. Agric., Ceylon,* 1938, **91**, 161-164.

The Cowry Shell. A Study of its History and Use in Nigeria. By M. D. W. Jeffreys. *Nigeria,* 1938, No. 15, 221-226.

FORESTRY

General

Internationales Adressbuch für Forstwirtschaft, Holzwirtschaft, Jagd und Naturschutz. By F. Grünwoldt. Teil I : Internationales und Nordamerika. Pp. 94, 9¾ × 7. (Berlin : Verlag von J. Neumann, 1938.) An international list of addresses of forestry and allied organisations. With notes in French and English.

Fourteenth Annual Report of the Imperial Forestry Institute, University of Oxford, for 1937-38. Pp. 36, 8½ × 5½. (Oxford : Imperial Forestry Institute, 1938.)

Report on the Forests Department, Western Australia, for the year ended June 30, 1938. Pp. 26, 13 × 8¼. (Perth : Government Printer, 1938.)

Report of the Forest Department of British Honduras for the year 1937. Pp. 15, 12½ × 8. (Belize : Government Printer, 1938.)

Waldnutzung im Westafrikanischen Urwald. Erfahrungen und Ansichten eines Holzexploiteurs. By E. Appel. *Z. Weltforstw.*, 1938, **6**, 95-101. Deals with the virgin forests of the Cameroons and their development, with a resumé in French.

Annual Report of the Forest Administration in Cyprus for the year 1937. Pp. 26, 13 × 8¼. (Nicosia : Government Printing Office, 1938.) Price 1*s.*

Report on the Forestry Department, Gold Coast, for the year 1937-38. Pp. 18, 13 × 8½. (Accra: Government Printing Department, Publications Branch, 1938.) Price 1*s*.

Annual Progress Report on Forest Administration in the Province of Bihar for the year 1936-37. Pp. 79, 13 × 8½. (Bihar, Patna: Superintendent, Government Printing, 1938.) Price Re. 1 As. 10.

Progress Report on Forest Administration in the Jammu and Kashmir State for the year ending October 15, 1937. Pp. 55, 9½ × 7. (Jammu: Government Press, 1938.)

Administration Report of the Forest Department of the Madras Presidency for the year ending March 31, 1937. Pp. 200, 9¾ × 6½. (Madras: Superintendent, Government Press, 1938.) Price Re. 1 As. 4.

The Forests of the Malay Peninsula and their Exploitation. By H. E. Desch. *Malay. For.*, 1938, **7**, 169-184.

A Report on the Forests of the Granitic Islands of the Seychelles. By H. S. Gibson. Pp. 50, 8½ × 6½. (Seychelles: Department of Agriculture, 1938.)

The Raising and Planting of Trees on the Farm. By E. J. K. Edwards. *Rhod. Agric. J.*, 1938, **35**, 876-889.

Eukalyptus-Anbau an der Südküste Anatoliens. By L. Tschermak. *Weltforstw.*, 1938, **6**, 3-18. The cultivation of eucalyptus trees on the southern coast of Anatolia.

Factors Affecting Establishment of Douglas Fir Seedlings. By L. A. Isaac. *Circ. No.* 486, *U.S. Dep. Agric.* Pp. 46, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

The Oak-leaf Roller Moth (*Tortrix viridana* L.). *Leafl. No.* 10 (*Reprinted* 1938) *For. Comm., Lond.* Pp. 3, 9½ × 6. (London: H.M. Stationery Office, 1938.)

Timber

British Standard Terms and Definitions Applicable to Hardwoods and Softwoods (Revised October, 1938.). *Brit. Stand. No.* 565, 1938. Pp. 43, 8½ × 5½. (London: British Standards Institution, 1938.) Price 2*s*.

North Borneo Standard Grading Rules. By H. G. Keith. *N. Borneo For. Rec. No.* 1 (*Revised*). Pp. 31, 9 × 6. (Sandakan, N. Borneo: Forest Department, 1938.) Price $1. Deals with the grading of round logs, squared logs, and sawn timber.

The Selection of Timber. Part 2. Structural Timber. *Tr. Circ. No.* 41, *Coun. Sci. Industr. Res. Aust.* Pp. 26, 9½ × 6. (Melbourne: Government Printer, 1938.)

The Selection of Timber. Part 3. Plywood—Its Use and Grading, together with Australian Standard Specification for Plywood, No. 0.6—1938. *Tr. Circ. No.* 42, *Coun. Sci. Industr. Res. Aust.* Pp. 10, 9½ × 6. (Melbourne: Government Printer, 1938.)

The Export Timbers of Nigeria. By J. R. Ainslie. Pp. 42, 9½ × 7¼. (Lagos: Department of Forestry, 1938.)

American Hardwood Flooring and its Uses. By W. L. Neubrech. *Bull. No.* 186, *Tr. Prom. Ser.*, *U.S. Dep. Comm.* Pp. 35, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Tests on Small Clear Specimens of Hoop Pine (*Araucaria cunninghamii*). By R. S. T. Kingston. *J. Coun. Sci. Industr. Res. Aust.*, 1938, **11**, 305-306. An interim report giving the average mechanical properties of the wood.

The Mechanical Properties of South Australian Plantation-grown *Pinus radiata* D. Don. By I. Langlands. *Pamphl. No.* 87, *Coun. Sci.*

Industr. Res. Aust. Pp. 55, 9½ × 6. (Melbourne: Government Printer, 1938.)

American Western Pines and their Uses. By W. L. Neubrech. *Bull. No.* 180, *Tr. Prom. Ser., U.S. Dep. Comm.* Pp. 34, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents. The timbers under consideration are Idaho White Pine, Ponderosa Pine and Sugar Pine.

A Note on Laurel Wood (*Terminalia tomentosa*) and its Market in Great Britain. By J. N. Sinha. *Indian For.*, 1938, **64**, 669-674.

Burma's Teak Industry. *Timb. and Plywood, Special Issue*, 1938, 8-13.

Decay of Timber and its Prevention. By W. P. K. Findlay. *Rec. No.* 27, *For. Prod. Res., Dep. Sci. Industr. Res.* Pp. 15, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 6*d*.

Tanning Materials and Leather

Knoppernextrakt. Ueber Versuche zur Herstellung und Verwendung eines Gerbextrakts aus Knoppern. By J. A. Sagoschen. *Collegium*, 1938, No. 823, 554-578. Describes trials carried out on the preparation of tanning extract from gall nuts and indicates the particular uses for the product.

A Study of Myrabolans. By A. Cheshire. *J. Int. Soc. Leath. Chem.*, 1938, **22**, 452-466, 480-505.

Utilisation of Myrobolans. Part I. Preparation and Purification of Myrobolan Extract. Part II. Myrobolan Oil. Part III. Utilisation of Myrobolan Extract for the Preparation of Ink and for Cotton Dyeing. By S. R. Sunthankar and S. K. K. Jatkar. *J. Indian Inst. Sci.*, 1938, **21A**, 131-147, 149-152, 153-158.

Aeroplane Dusting Against Wattle Bagworm. By L. R. Ripley and B. K. Petty. *Frmg. S. Afr.*, 1938, **13**, 423. Describes the treatment of this pest with cryolite.

A Comparison of Packer and Brine Cured Hides. By F. L. De Beukelaer. *J. Amer. Leath. Chem. Ass.*, 1938, **33**, 470-478.

Mange in the Living Animal and its Result in the Finished Leather. By M. E. Robertson. *Leath. World*, 1938, **30**, 1267-1270.

Gums and Resins

Wood Naval Stores Industry. Its Rise and Development. By W. Garvie. *Oil Col. Tr. J.*, 1938, **94**, 1367-1376. Discusses the various products derived directly or indirectly from the pine tree, living or dead, which come under the definition of " wood naval stores."

Annual Report of the London Shellac Research Bureau, Indian Lac Cess Committee, for 1937-38. By A. J. Gibson. Pp. 16, 8¼ × 5½. (London: India House, 1938.)

Annual Report of the Indian Lac Research Institute for 1937-38. Pp. 43, 9½ × 7¼. (Namkum, Ranchi, Bihar: Indian Lac Research Institute, 1938.)

Shellac: Ancient and Modern. By R. Bhattacharya and A. J. Gibson. *Oil Col. Tr. J.*, 1938, **94**, 1581-1586. An account of the raw material, its physical properties and its utilisation.

Onderzoek der Balsems van Verschillende Pinus-soorten, Afkomstig van Noord-Sumatra. By P. A. Rowaan en J. W. Gonggrijp. *Tectona*, 1938, **31**, 876-880. Notes on the examination of the balsams of *Pinus merkusii*, *P. insularis* and *P. khasya* from Northern Sumatra. Summary in English.

Synthetic Resins and their Raw Materials. *Rep. No.* 131 (*2nd Ser.*), *U.S. Tariff Comm.* Pp. 162, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 25 cents. A survey of the types and uses of synthetic resins, the organisation of the industry and the trade in resins and raw materials.

IMPERIAL INSTITUTE

CONSULTATIVE COMMITTEE ON INSECTICIDE MATERIALS OF VEGETABLE ORIGIN

QUARTERLY BIBLIOGRAPHY ON INSECTICIDE MATERIALS OF VEGETABLE ORIGIN, NO. 5

(October to December 1938)

Prepared in collaboration with the Imperial Institute of Entomology and the Department of Insecticides and Fungicides, Rothamsted Experimental Station.

GENERAL

Review of United States Patents relating to Pest Control. Vol. II (1938), Nos. 6, 7, 8, 9 and 10. By R. C. Roark. *Bur. Ent., U.S. Dept. Agric.*

List of Publications of the Division of Insecticide Investigations, Bureau of Entomology and Plant Quarantine, Washington, for the three months ending September 30, 1938, together with list of U.S. Patents by members of the Division granted during the same period.

Pflanzliche Insektizide (Pyrethrum, Derris, Mundulea, Lonchocarpus, Tephrosia u.a.). By K. Jung. *Tropenpflanzer*, 1938, **41**, No. 10, 431-443.

Les Essais de Culture des Plantes Médicinales, Aromatiques et Similaires au Congo Belge. By L. Pynaert. *Bull. Off. Colon. Brux.*, 1938, **27**, No. 9, 641-642. Includes brief notes on pyrethrum, derris, *Rauwolfia vomitoria* and *Paullinia pinnata*.

Matériaux pour l'Étude des Plantes Medicinales Indigènes du Congo Belge. By P. Staner. *Mém. Inst. Roy. Col. Belge.*, 1938, **5**, fasc. 6. Contains brief references to the following plants reputed to possess insecticidal properties: *Agauria salicifolia, Balanites ægyptiaca, Barteria fistulosa, Canthium venosum, Dasylepsis sereti, Dewevrea bilabiata, Dixoglypremna caloneura, Embelia schimperi, Fagara gilletii, Fagara kelekete, Lactuca gilletii, Lindackeria dentata, Melinis minutiflora, Pentaclethra macrophylla, Physostigma venosum, Quassia africana, Rauwolfia vomitoria, Tabernanthe iboga, Tephrosia vogelii* and *Triplotaxis stellulifera.*

Annual Report of the Department of Agriculture, Mysore, for the year 1936-37. Includes notes on chemical and biological investigations being carried out with *Derris elliptica, Mundulea suberosa, Tephrosia candida* and *Annona reticulata.*

Twenty-seventh Report of the Connecticut State Entomologist, 1937. Includes tests with nicotine, derris and cube against the European corn borer (*Pyrausta nubilalis*), nicotine and cube against onion thrips (*Thrips tabaci*), nicotine and cube against the oriental fruit moth (*Grapholitha molesta*), pyrethrum against the squash bug (*Anasis tristis*), and rotenone dusts against the apple maggot (*Rhagolctis pomonella*).

Breeding Houseflies. A Simplified and more Convenient Method of Rearing and Handling Flies for Peet-Grady Tests. By E. G. Thomssen and M. H. Doner. *Soap*, 1938, **14**, No. 10, 89-90, 101.

A Note on Rearing Houseflies. By C. Eagleson and R. Benke. *Soap*, 1938, **14**, No. 11, 109, 119.

Toxikologische Probleme in der Schädlingsbekampfung. By F. Stellwaag. *Angew. Chemie*, 1938, **51**, No. 35, 589-594. Discusses methods of determining toxicity and the interpretation of results.

A Method for Investigating Membrane Permeability. By S. T. P. Brightwell. *Bull. Ent. Res.*, 1938, **29**, Pt. 4, 391-403.

ALKALOID-CONTAINING MATERIALS

Tobacco Products, including Nicotine and Nicotine Derivatives

Method of De-basing New Jersey Peat. By L. N. Markwood. *Industr. Engng. Chem., Industr. Ed.*, 1938, **30**, No. 10, 1199. For the preparation of nicotine peat and humate.

Report of the Department of Entomology, Massachusetts Agricultural Experiment Station, 1937. *Bull. No.* 347 (1938) *Mass. Agric. Exp. Sta.* Includes reports on experiments with nicotine insecticides against the white apple leaf hopper (*Typhlocyba pomaria*), *Dasyneura mali*, squash vine borer (*Melittia satyriniformis*), flea beetle (*Epitrix cucumeris*), European corn borer (*Pyrausta nubilalis*). (*R.A.E.*, 1938, **26**, A, Pt. 11, 647.)

Papers on Orchard Pests and their Control. *Trans. Ill. Hort. Soc.*, 1937, Vol. 17. Includes account of experiments with nicotine insecticides against codling moth (*Cydia pomonella*), and oriental fruit moth (*C. molesta*). (*R.A.E.*, 1938, **26**, A, Pt. 11, 652.)

The Phytocidal Properties of Petroleum Oil Sprays Alone and in Combination with Lime-Sulphur. By H. G. H. Kearns, R. W. Marsh and H. Martin. *Ann. Rep. Long Ashton Agric. Hort. Res. Sta., Bristol*, 1937, 65-77. Includes use of a combined wash of grade G petroleum oil, sulphite lye emulsion, lime sulphur and nicotine.

Substitute Spray Materials. By S. A. McCory and C. G. Vinson. *Res. Bull.* 292 (1938), *Missouri Agric. Exp. Sta.* Includes work with nicotine insecticides against codling moth.

Codling Moth Control Experiments, 1937-38. By K. M. Ward. *Queensld. Agric. J.*, 1938, **50**, Pt. 3, 286-294. Includes tests with sprays containing nicotine sulphate.

The Apple Leaf Jassid in South Australia. By H. K. Kemp. *J. Dep. Agric., S. Australia*, 1928, **42**, No. 4, 394-401. Use of nicotine sulphate spray.

Ornix prunivorella Chambers, a Pest of the Apple Tree in the Lower Missouri River Valley Region. By L. M. Copenhafer and R. L. Parker. *Amer. Chem. Abstr.*, 1938, **32**, No. 21, 8677. A brief abstract of a paper in *J. Kansas Ent. Soc.*, 1938, **11**, 37-38, giving an account of the use of nicotine sprays for the control of the pest.

The Control of Banana Rust Thrips. By N. E. H. Caldwell. *Queensld. Agric. J.*, 1938, **50**, Pt. 4, 422-449. Includes results of experiments with nicotine.

Citrus Pests: Black Aphis and Mealy Bugs. By W. Cottier. *N.Z. J. Agric.*, 1938, **57**, No. 4, 332-333. Includes notes on control with nicotine sulphate sprays.

Insects of the Blackberry, Raspberry, Strawberry, Currant and Gooseberry. By A. J. Hanson and R. L. Webster. *Pop. Bull. No.* 155 (1938) *Washington Agric. Exp. Sta.* Includes references to the use of nicotine sprays.

Control of Bean Fly. Experiments Demonstrate the Efficiency of Nicotine Sulphate-White Oil. By W. L. Morgan. *Agric. Gaz. N.S. Wales*, 1938, **49**, Pt. 9, 501-503.

Ziekten en Plagen van de Champignoncultuur. (Diseases and Pests of Cultivated Mushrooms.) By S. Broekhuizen. *Tijdschr. Plantenziekt.*, 1938, **44**, Pt. 3, 113-140. Includes notes on the use of nicotine insecticides. (*R.A.E.*, 1938, **26**, A, Pt. 11, 655.)

Diseases and Pests of Chrysanthemums. By W. E. H. Hodson. *Sci. Hort.*, 1938, **6**, 67-71. Includes a note on spraying against the eelworm (*Aphelenchoides ritzema-bosi*) with nicotine.

The Effect of Nicotine on Bees. By F. K. Böttcher. *Bee World*, 1938, **20**, No. 1, 10. Abstract of articles in *Gartenbauwissenschaft*, 1938, **12**, No. 2.

Nicotine Sulphate: its Use in the Treatment of Cattle Lice (*Hæmatopinus eurysternus* Nitzsch.). By F. H. S. Roberts and J. Legg. *Aust. Vet. J.*, 1938, **14**, No. 2, 55-58. (*R. A. E.*, 1938, **26**, B, Pt. 11, 214.)

Internal Parasites of Sheep. By W. J. Jenkins. *J. Dep. Agric. S. Aust.*, 1938, **42**, No. 1, 64-65. Reference is made to the use of nicotine sulphate in conjunction with copper sulphate.

On the Toxicity of Nicotine for Sheep and the Use of Nicotine-Bluestone Drench for Worms in Ruminants. By H. O. Monnig. *Vet. Bull.*, 1938, **8**, No. 12, 810. Abstract of paper in *Rev. Med. Trop. Parasit., Habana*, 1937, **3**, 3-10.

Nicotine Factory Established in Egypt. *World Trade Notes, U.S. Dep. Comm.*, 1928, **12**, No. 41, 697. Brief note regarding the proposal for the establishment of a factory under Government auspices, the plans for which are now completed.

Anabasine

The Study of *Anabasis aphylla* with a View to its Economic Exploitation. (In Russian.) By M. M. Ilyin. *Bot. Inst. Acad. Sci. U.S.S.R.*, 1938, Ser. V, fasc. 1, 401-416.

Others

Die Alkaloide von *Veratrum album* (White Hellebore). By W. Poeke. *Arch. Pharmaz. Ber. Dtsch. Pharm. Ges.*, 1937, **275**, 357-379, 571-599; 1938, **276**, 170-181.

INSECTICIDE MATERIALS CONTAINING ROTENONE AND ALLIED SUBSTANCES

General

Abstracts of Foreign and Domestic Patents relating to Derris, Lonchocarpus, Tephrosia and Rotenone. By R. C. Roark. *E*-446 (1938) *Bur. Ent. U.S. Dep. Agric.* Pp. 69.

Contribution à l'Étude Chimique des Légumineuses Insecticides du Congo Belge. By E. Castagne. *Mém. Inst. Roy. Col. Belge.*, 1938, Tome VI, fasc. 3. Pp. 102. Deals with species of *Derris, Lonchocarpus, Tephrosia* and *Milletia* and gives analyses of various parts of the plant and their content of active principles. The monograph is illustrated with coloured sketches and with histological diagrams showing the structure of the root, etc.

Les Légumineuses à Roténone de la Flore Malgache. By P. Boiteau. *Bull. Écon. Madagascar*, 1938, Pt. 2, 111-129. Description of thirty-two species of *Derris, Lonchocarpus, Mundulea, Tephrosia, Milletia, Chadsia* and *Phylloxylon*.

A Titrimetric Step in Determining Rotenone. By H. A. Jones. *Indust. Engng. Chem., Anal. Ed.*, 1938, **10**, No. 12, 684-685.

Contribution à l'Étude des Poudres Roténonées. By G. Chevalier and P. Laffond. *Compt. Rend. Acad. Agric., France*, 1938, **24**, No. 10, 380-386.

Control of the Pea Weevil in Oregon with especial reference to Peas Grown for Processing. By J. C. Chamberlain and K. W. Gray. *Amer. Chem. Abstr.*, 1938, **32**, No. 19, 7645. Very brief abstract of *Circ. No.* 126, *Oregon Agric. Exp. Sta.*, which deals with the control of this pest by dusts containing rotenone.

The Holly Leaf Miner (*Phytomyza ilicicola* Loew.) and its Control. By G. S. Langford and E. N. Cory. *Amer. Chem. Abstr.*, 1938, **32**, No. 20, 8062. Brief abstract of a paper in *Proc. Nat. Shade Tree Conf.*, 1937, **13**, 109-112, dealing with control by rotenone sprays.

The Control of Cattle Lice. By O. G. Babcock. *E*-447 (1938) *Bur. Ent., U.S. Dep. Agric.* Includes note on the use of rotenone-containing materials.

The Biological Disposition of Rotenone after Ingestion by the Southern Army Worm. By P. A. Woke. *J. Agric. Res.*, 1938, **57**, No. 9, 707-712.

Derris

References to Reviews and Popular Articles on Derris. By R. C. Roark. *E*-457 (1938) *Bur. Ent., U.S. Dep. Agric.* Pp. 28.

Tenth Annual Report of the East African Research Station, Amani, April 1, 1937 to December 31, 1937. Includes brief notes on the progress in research on derris carried out at the station.

Annual Report of the Department of Agriculture, Malaya, for the year 1937. Includes brief notes on the economic, agricultural and research aspects of derris cultivation.

Reports of the Field Branch of the Department of Agriculture, Straits Settlements and Federated Malay States, for the year 1937. Includes brief notes on the position of derris cultivation in the various districts.

Recent Research on Derris in Malaya. *Bull. Imp. Inst.*, 1938, **36**, No. 4, 527-529. Includes notes on selection and entomological work.

Derris Planting Commercialised—Formosa. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 43, 731. Note on the formation of a company to grow derris, together with particulars of area at present under cultivation and proposed programme.

Derris Plantings increased—Philippines. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 40, 680. Note on the estimated area under the crop.

Derris Milling Planned—Philippine Islands. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 46, 787. Brief reference to proposal to build plant for the grinding of derris and production of insecticides.

Derris ferruginea Benth. from Assam. By S. Krishna and T. P. Ghose. *Current Science*, 1938, **7**, No. 1, 22.

Some Further Examples of Rotenone Determinations on Derris, Timbo, and Barbasco. By W. M. Seaber. *J. Soc. Chem. Indust., Lond.*, 1938, **57**, No. 10, 372.

Over de Analyse van Derris en Lonchocarpuswortels en de Samenstelling van hun Extracten. By P. A. Rowaan and A. J. van Duuren. *Chem. Weekblad.*, 1938, **35**, No. 44, 755-756.

Over de Waardeering van Derris. By T. M. Meyer. Reprint from *Verslag van de 25e Vergadering van de Vereeniging van Proefstation Personeel, Buitenzorg*, October, 1937. Deals with the estimation of derris.

Eenige Eigenschappen van Derriswortel. By T. H. Meijer. *Bergcultures*, 1938, **12**, No. 46, 1562-1563. Account of experiments carried out on the influence of temperature on the rotenone content and ether extract figures of derris root and also on the hygroscopic properties of the powder.

A New Compound from *Derris elliptica* Resins. By S. H. Harper. *J. Soc. Chem. Ind., Lond.*, 1938, **57**, 1059.

Buckley's Substance, m.p. 183°, from Derris Extract. By J. J. Boam and R. S. Cahn. *J. Chem. Soc., Lond.*, 1938, November, 1818-1820.

Discussion of the Term "Derris Resinate." By R. C. Roark. *J. Econ. Ent.*, 1938, **31**, No. 4, 545.

Derris. Effect of Sunlight and Rain on Derris Deposits as studied in the Laboratory. By R. D. Chisholm and L. D. Goodhue. *Soap*, 1938, **14**, No. 12, 117, 119, 131.

Report of the Department of Entomology, Massachusetts Agricultural Experiment Station, 1937. *Bull. No.* 347 (1938) *Mass. Agric. Exp. Sta.* Includes reports on experiments with derris insecticides against the flea beetle (*Epitrix cucumeris*), European corn borer (*Pyrausta nubilalis*), and red spider (*Tetranychus telarius*). (*R. A.E.*, 1938, **26**, A, Pt. 11, 647.)

Verslag van het Deli Proefstation over het jaar 1937. *Med. Deli Proefsta. Medan-Sumatra.* Ser. 2, No. 100. Includes report on tests with derris insecticides.

The Control of Banana Rust Thrips. By N. E. H. Caldwell. *Queensld. Agric. J.*, 1938, **50**, Pt. 4, 422-449. Includes results of experiments with derris.

Insects of the Blackberry, Raspberry, Strawberry, Currant and Gooseberry. By A. J. Hanson and R. L. Webster. *Pop. Bull. No.* 155 (1938), *Washington Agric. Exp. Sta.* Includes references to the use of derris dusts and sprays.

Life History and Habits of the Cotton Bollworms in the Philippines with Suggestions for their Control. By F. L. Butac. *Philippine J. Agric.*, 1938, **9**, No. 2, 137-150. Includes a note on tests against *Earias fabia* with derris insecticides.

Report of the Cranberry Station, East Wareham, Massachusetts, 1937. *Bull. No.* 347 (1938) *Mass. Agric. Exp. Sta.* Includes notes of experiments with derris against the cranberry fruitworm (*Mineola vaccinii* Riley). (*R. A.E.*, 1938, **26**, A, Pt. 11, 645.)

Tests with Derris or Cube Powder in Rosin Residue Emulsion Sprays for the Control of Shade Tree Insects. By C. C. Hamilton. *Amer. Chem. Abstr.*, 1938, **32**, No. 20, 8063. Brief abstract of paper in *Proc. Nat. Shade Tree Conf.*, 1937, **13**, 140-147.

The American Dog Tick, Eastern Carrier of Rocky Mountain Spotted Fever. By F. C. Bishopp and C. N. Smith. *Circ.* 478 (1938), *U.S. Dep. Agric.* Includes note on the use of derris for its control.

The Use of Derris in the Control of Earthworms. By R. B. Dawson, B. M. Boyns and R. W. Shorrock. *J. Bd. Greenkeeping Res.*, 1938, **5**, No. 19, 249-257.

How to Control Fleas. By F. C. Bishopp. *Leaflet No.* 152 (1937), *U.S. Dep. Agric.* Includes note on the use of derris powder.

Warble Fly Pest. *Leather World*, 1938, **30**, No. 49, 1244-1245. A report of the visit of a deputation from the Hide Improvement Society to the Ministry of Agriculture, urging that steps should be taken to ensure the greater effectiveness of the Warble Fly (Dressing of Cattle) order.

Lonchocarpus

Lonchocarpus (Barbasco, Cube and Timbo)—A Review of Recent Literature. By R. C. Roark. *E*-453 (1938), *Bur. Ent.*, *U.S. Dep. Agric.* Pp. 174.

Administration Report of the Director of Agriculture, British Guiana, for the year 1937. Includes brief notes on the position of Black and White Haiaris.

Some Further Examples of Rotenone Determinations on Derris, Timbo and Barbasco. By W. M. Seaber. *J. Soc. Chem. Industr., Lond.*, 1938, **57**, No. 10, 372.

Over de Analyse van Derris en Lonchocarpuswortel en de Samenstelling van hun Extracten. By P. A. Rowaan and A. J. van Duuren. *Chem. Weekblad*, 1938, **35**, No. 44, 755-756.

Report of the Department of Entomology, Massachusetts Agricultural Experiment Station, 1937. *Bull. No.* 347 (1938) *Mass. Agric. Exp. Sta.* Includes reports on experiments with cube insecticides against *Dasyneura mali*, squash vine borer (*Melittia satyriniformis*),

striped cucumber beetle (*Diabrotica melanocephala*), carrot rust fly (*Psila rosae*), flea beetle (*Epitrix cucumeris*), and red spider (*Tetranychus telarius*). (*R.A.E.*, 1938, **26**, A, Pt.11, 647.)

Report of the Cranberry Station, East Wareham, Massachusetts, 1937, *Bull. No.* 347 (1938) *Mass. Agric. Exp. Sta.* Includes note of experiments with cube against the cranberry fruitworm (*Mineola vaccinii* Riley). *R.A.E.*, 1938, **26**, A, Pt.11, 645.)

Insects of the Blackberry, Raspberry, Strawberry, Currant and Gooseberry. By A. J. Hanson and R. L. Webster. *Pop. Bull. No.* 155 (1938), *Washington Agric. Exp. Sta.* Includes references to the use of cube dusts and sprays.

Experiments in Control of the Tobacco Flea Beetle during 1937. By N. Allen, J. W. Humphreys and D. W. Hookom. *Rep. S. Carolina Exp. Sta.*, 1936-37, 112-117. Account of successful control with cube dust.

Tests with Derris or Cube Powder in Rosin Residue Emulsion Sprays for the Control of Shade Tree Insects. By C. C. Hamilton. *Amer. Chem. Abst.*, 1938, **32**, No. 20, 8063. Brief abstract of paper in *Proc. Nat. Shade Tree Conf.*, 1937, **13**, 140-147.

Timbo Root Exports Chiefly in Ground Condition—Brazil. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 50, 866.

Cube Exports *via* West Coast Expanding—Peru. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 45, 771.

PYRETHRIN-CONTAINING MATERIALS

L'Agriculture du Congo Belge en 1937. *Bull. Agric. Congo Belge*, 1938, **29**, No. 3, 500, 502. Includes account of experiments which are being conducted with pyrethrum in the province of Costersmanville, Belgian Congo.

Pyrethrum in the Iringa District of Tanganyika. By C. J. McGregor. *Leaflet No.* 11, *Dep. Agric., Tanganyika.*

Some Observations on Farming Economics in the Nakuru District. By V. Liversage. *E. Afr. Agric. J.*, 1938, **4**, No. 3. Includes a note on the cost of producing pyrethrum on two farms.

Pyrethrum Cultivation Planned—Netherlands. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 51, 883.

Pyrethrum Cultivation Studied—Peru. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 47, 811. Note on work which is being done to encourage pyrethrum cultivation in Peru.

Fifty-first Annual Report of the Agricultural Experiment Station, Nebraska, for the year 1937. Includes brief note on p. 21 of experiments with the cultivation of pyrethrum during the past few years.

Untersuchungen über den Einfluss von Pflanzenschutzmitteln auf die Bienen. III. Die Wirkung von Pyrethrum auf die Bienen. *Zeitschrift für Angewandte Entomologie*, 1938, **25**, Heft 3, November, 419-441.

Fly Spray Analysis. Pyrethrin Determination in Referee Samples of Insecticide—a Study of Methods by the Pacific Coast Insecticide Association. *Soap*, 1938, **14**, No. 10, 91, 93, 95.

Co-operative Tests of Housefly Sprays, 1935-1936. *E*-436 (1938), *Bur. Ent., U.S. Dep. Agric.*

Preparation of Pyrethrins. Isolation of Pyrethrin II—Effect of Aqueous Extraction on Pyrethrin Content of Pyrethrum. By M. S. Schechter and H. L. Haller. *Soap*, 1938, **14**, No. 11, 101, 103.

Pyrethrum Evaluation. Relation of Pyrethrin Content of Pyrethrum Flowers to their Toxicity to Mosquito Larvæ. By M. S. Lowman and W. N. Sullivan. *Soap*, 1938, **14**, No. 11, 89-91, 93, 119.

Report of the Department of Entomology, Massachusetts Agri-

cultural Experiment Station, 1937. *Bulletin No.* 34 (1938) *Mass. Agric. Exp. Sta.* Includes reports on experiments with pyrethrum insecticides against the white apple leaf hopper (*Typhlocyba pomaria*), flea beetle (*Epitrix cucumeris*) and red spider (*Tetranychus telarius*). (*R.A.E.*, 1938, **26**, A, Pt. 11, 647.)

The Control of Banana Rust Thrips. By N. E. H. Caldwell. *Queensld. Agric. J.*, 1938, **50**, Pt. 4, 422-449. Includes results of experiments with pyrethrum.

Report of the Cranberry Station, East Wareham, Massachusetts, 1937. *Bull. No.* 347 (1938) *Mass. Agric. Exp. Sta.* Includes account of experiment with pyrethrum dust against *Anthonomus musculus*, Say. (*R.A.E.*, 1938, **26**, A, Pt. 11, 645.)

Experiments on the Control of Pear Bud Moth (*Anthonomus cinctus* Kollar), with a preliminary Note on its Life History. By O. Jancke. *Amer. Chem. Abstr.*, 1938, **32**, No. 22, 9377. Very brief abstract of paper in *Z. Pflanzenkrankh. Pflanzenschutz.*, 1938, **48**, 411-424, dealing with the use of pyrethrum insecticides.

The Holly Leaf Miner (*Phytomyza ilicicola* Loew) and its Control. By G. S. Langford and E. N. Cory. *Amer. Chem. Abstr.*, 1938, **32**, No. 20, 8062. Brief abstract of a paper in *Proc. Nat. Shade Tree Conf.*, 1937, **13**, 109-112, dealing with control by pyrethrum sprays.

Ziekten en Plagen van de Champignoncultuur. (Diseases and Pests of Cultivated Mushrooms.) By S. Broekhuizen. *Tijdschr. Plantenziekt.*, 1938, **44**, Pt. 3, 113-140. Includes notes on the use of pyrethrum insecticides. (*R.A.E.*, 1938, **26**, A, Pt. 11, 655.)

The Use of Protective Films of Insecticide in the Control of Indoor Insects with Special Reference to *Plodia interpunctella* Hb. and *Ephestia elutella* Hb. By C. Potter. *Ann. Appl. Biol.*, 1938, **25**, No. 4, 837-854. Experiments on the successful use of a spray consisting of a solution of pyrethrins in white oil.

How to Control Fleas. By F. C. Bishopp. *Leaflet No.* 152 (1937), *U.S. Dep. Agric.* Includes note on the use of pyrethrum powder.

Synthetic Insecticides. A Further Study of the Value of Alpha Naphthyl Isothiocyanate in Fly Sprays. By N. Tischler and J. Stones. *Soap*, 1938, **14**, No. 10, 97, 99. Tests with the compound in conjunction with pyrethrins.

Pyrethrum Larvicides for Mosquito Control. *E*-456 (1938) *Bur. Ent., U.S. Dep. Agric.* Pp. 3.

Pyrethrum Production Maintained—Japan. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 45, 772. Gives figures of crop and acreage for 1938.

Pyrethrum as Insecticide. Setting up a New Industry in Kenya. *Manchester Guardian Commercial*, 1938, **37**, No. 956, 364.

Pyrethrum Crop Small—Yugoslavia. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 42, 714.

Pyrethrum Crop Reported Unsold—Yugoslavia. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 50, 866.

Jugoslavian Pyrethrum Prospects. *Chem. Tr. J.*, 1938, **103**, No. 2685, 422. A very brief note on the position of the current crop.

OTHER INSECTICIDE MATERIALS OF VEGETABLE ORIGIN

Une Acanthacée du Gabon qui sert à Narcotiser le Poisson. By R. Benoit. *Rev. Bot. Appl.*, 1938, **18**, No. 204-205, 624-625. A note on *Distichocalyx walkeri* R. Benoist nov. sp.

Larvicides for Antimosquito Work, with Special Reference to Cashew Nut Shell Oil. By R. C. Wats and K. H. Bharucha. *J. Malar. Inst. India*, 1938, **1**, No. 2, 217-219. (*R.A.E.*, 1938, **26**, B, 234.)

Olive Oil as an Insecticide. *Hadar*, 1938, **3**, No. 9, 276. Note on the use of olive oil as a substitute for mineral oil.

Versuche zur Bekämpfung der Pflaumensägewespen mit Quassialhältigen Fertigpräparaten. (Experiments against Plum Sawflies with ready-made Preparations containing Quassia.) By H. Thiem. *Forschungsdienst*, 1938, **5**, 553-567. (*R. A.E.*, 1939, **27**, A, Pt. 1, 46.)

NOTE.—The reference in brackets—*R. A.E.*, etc.—which appears after certain items of the bibliography indicates the part and page of the *Review of Applied Entomology* in which an abstract of the publication mentioned can be found.

BOOK REVIEWS

Books for review should be addressed to "The Editor," Bulletin of the Imperial Institute, South Kensington, London, S.W.7.

AN AFRICAN SURVEY. A Study of Problems arising in Africa South of the Sahara. By Lord Hailey, G.C.S.I., G.C.I.E. Pp. xxviii + 1837, $8\frac{1}{2} \times 5\frac{1}{2}$. (London, New York, Toronto: Humphrey Milford, Oxford University Press, 1938.) Price 21*s*.

As the result of a suggestion made by General Smuts in the course of his Rhodes Memorial Lecture at Oxford in 1929, a Committee was set up with the object of compiling a comprehensive and objective survey of African conditions and the social, scientific and administrative problems of the Continent south of the Sahara. The present volume, issued by the Committee under the auspices of the Royal Institute of International Affairs, is the outcome of this action, and makes available for general use an immense mass of information which has not hitherto been available in collected form. The work of many expert contributors in the various fields has been brought together, and the result is a bulky volume full of valuable matter of the greatest interest to all concerned with the vast region in question.

The principal sections of this authoritative work are: The African Peoples; Systems of Government; Native Administration; the State and the Land; Agriculture; Education; Economic Development; Minerals and Mines. The citing of these headings, however, gives little idea of the amount of information contained in the 1,800 pages of the book, which is a publication of outstanding importance and potential utility, issued at a price which is remarkably low and should greatly assist in extending the circle of readers.

It should be mentioned that a critical and instructive survey of the volume has been made for The Royal African Society by the Rt. Hon. Lord Harlech and a number of highly-qualified collaborators, and published as a supplement to the Society's *Journal* for January 1939. The supplement has been issued as a separate publication at the price of 2*s*. (London: Macmillan & Co., Ltd.; New York: The Macmillan Co.).

SCIENCE IN AFRICA. A Review of Scientific Research relating to Tropical and Southern Africa. By E. B. Worthington, M.A., Ph.D. Pp. xiii + 746, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: Humphrey Milford, Oxford University Press, 1938.) Price 10s. 6*d*.

This volume is closely related to *An African Survey* noticed above. Dr. Worthington travelled with Lord Hailey during part of his tour in Africa in connection with the compilation of the Survey, and as explained in Lord Hailey's Foreword to the present work, he was asked, in view of his previous experience in the field of African biology, and especially zoology, to prepare a Report on the progress of scientific research having a bearing on that Continent. It was eventually decided to issue Dr. Worthington's Report in the present form as a self-contained publication, though it is in effect a supplement to *An African Survey*.

Dr. Worthington acknowledges in his Preface the assistance he obtained from numerous official and other authorities of various nationalities in the compilation of the Report, for which, however, he accepts final responsibility. The volume is an extremely useful compendium of present-day scientific and technical knowledge in regard to Africa: it covers geology, meteorology, botany, agriculture, forestry, zoology, entomology, medicine, industries and other subjects of importance, and is worth perusal by expert and general reader alike, quite apart from its intimate connection with Lord Hailey's own monumental work.

LORDS OF THE SUNSET. A Tour in the Shan States. By Maurice Collis. Pp. 326, $8\frac{3}{4} \times 5\frac{1}{2}$. (London: Faber & Faber, Ltd., 1938.) Price 15*s*.

Maurice Collis, the author, had already visited Burma and Siam and written interesting accounts of his travels when he accepted an invitation of a friend, a District Commissioner in the Shan States, to visit that country early in 1938. The present volume describes his experiences during the tour which had been arranged for him, and forms a delightful travel book about a charming people living in the midst of beautiful scenery. The author received much hospitality from the various Chiefs of the Shan States and had the opportunity of studying them and their environment at close quarters. His book reflects his enthusiastic appreciation of their system of enlightened personal rule under the aegis of British advisory officials.

A note of particular interest is that which relates to the importance of the north-east frontier of Burma in the light of Japanese penetration into China. The author points out that in the future the economic and political significance of the Irrawaddy and the Burma railways system will be considerably

enhanced by the growing necessity for an overland trade route from Burma to China *via* the Shan States.

The author also touches on various other economic matters, such as the result of the application of modern technique in the Silver Mines at Bawdwin and the possible exhaustion of the local deposits and the necessity in the future of importing Chinese ore to keep the mill and smelter working. He gives a somewhat glowing account of the new tung oil plantations and enters a plea for the adoption of a considerate and beneficial policy in their development so that the inhabitants may participate in the profits of the industry.

A map of the Shan States marked with the route taken assists the reader in following more closely the course of the author's travels.

L'ANNUAIRE DU COMMERCE INTERNATIONAL (L'ANNUAIRE BLEU), 1938. Pp. xi + 1,000, $10\frac{3}{4} \times 8\frac{1}{4}$. (Paris: Centre d' Expansion Française, 1938.) Price 30*s*.

The Centre d' Expansion Française exists to provide French business men with assistance and information on matters relating to trade at home and abroad, and in addition has an office at Paris where foreign business men may obtain information and be put in touch with French producers. *L' Annuaire Bleu* is published by the Centre with these ends in view.

The first and most important section of the book contains lists of firms engaged in all spheres of trade and industry in France, and information regarding customs duties, passports, addresses of Consuls, principal hotels, etc. Other sections deal with every other country in the world of any commercial importance, but the book is more than a mere directory, since a general account of the administration, geography, money, communications and industries is given for each country dealt with. In most cases a map showing the railways, canals and administrative districts is also included.

The book contains much useful information for firms engaged in trade with France and her Colonies, and to business men intending to travel abroad.

INTRODUCTION TO THE BOTANY OF FIELD CROPS. By J. M. Hector. Volume I. Cereals. Pp. xxxiv + 478. Volume II. Non-Cereals. Pp. xxxiii + 479-1127, 10×7. (Johannesburg: Central News Agency, Ltd.; London: Gordon & Gotch, Ltd.) Price 70*s*. net per set.

As the author has pointed out in his preface, our knowledge of the botany of certain crop plants is now far more detailed than that of any other genera on species, and yet in courses on "pure botany" there is often little enough made of this knowledge. The information is for the most part widely

scattered in different publications, and in bringing it together in these two volumes the author has done a useful service to botany.

With its fund of information on such aspects as the formation of root systems, cytology and classification of varieties—to quote a few—and the lengthy bibliographies on each crop, the book will prove valuable in a variety of fields, but possibly most of all for the research worker in experimental agriculture.

The crops dealt with are essentially those normally grown in rotation on arable land, as opposed to orchard and plantation crops, Volume I being concerned with the Gramineæ and Volume II with other families. With a few exceptions, such as cassava, all the more important field crops are included, but it is inevitable in a book of this type that the treatment should be somewhat uneven, as some crops have been the object of so much more research work than others. In this way the book serves to show up gaps where further research is needed.

The text is well illustrated with numerous drawings and photographs, but of these it must be said that their value would have been very much greater if more care had been taken to make the legends explicit. Thus, for example, in many of the figures showing plant-sections no reference whatever is made to the plant concerned, except in the text, the legends reading simply "Cross-section of young fleshy root" or "Transverse section of mature stolon," etc.

It is convenient that the volumes are complete in themselves, each containing an author index, an index of plant names and a general index.

GERMAN-ENGLISH BOTANICAL TERMINOLOGY—ENGLISCH-DEUTSCHE BOTANISCHE TERMINOLOGIE. An Introduction to German and English Terms used in Botany, including Plant Physiology, Ecology, Genetics and Plant Pathology. By Helen Ashby, Ph.D., D.I.C., Eric Ashby, D.Sc., D.I.C., Dr. Harald Richter and Dr. Johannes Bärner. Pp. xi + 195, 8½ × 5¼. (London: Thomas Murby & Co., 1938.) Price 10s.

This book is something more than a mere dictionary of botanical terms. It takes the form of a concise survey of the various branches of botanical science, written in English and German, and set out side by side. Botanical terms are picked out in italics and can readily be traced from the English and German indexes, each of which contains some 3,000 entries. The terms likely to be encountered in reading either the English or German literature on any particular branch of botany are thus grouped together in the appropriate chapter or section, and being in their proper context the exact meaning is in many cases better conveyed than would be possible from a dictionary definition.

A merit of the book lies in the wide range of the subject

matter it includes, and from the point of view of the economic botanist the Appendices form an especially valuable contribution. The first of these gives a list of over 650 commonly occurring wild and cultivated plants together with their English and German names, the second tabulates in English and German the names, causes and host plants of over 200 plant diseases of parasitic or physiological origin. In a third appendix are collected together the abbreviations commonly used in English and German botanical literature, with explanations of their meaning.

PLANT GROWTH-SUBSTANCES. Their Chemistry and Applications, with Special Reference to Synthetics. By Hugh Nicol. Pp. xii + 108, 8½ × 5½. (London: Leonard Hill, Ltd., 1938.) Price 3*s*. 6*d*.

The bulk of the work published on "plant hormones" in recent years has been primarily concerned with their physiological effects on plants and the commercial possibilities attending their use in agriculture and horticulture. This book, however, is essentially a review of the present position with regard to the chemistry of these substances, and a large part of the text assumes a thorough knowledge of organic chemistry on the part of the reader. It seems, in view of this, that the two introductory chapters "for the layman" are somewhat out of place.

The various types of growth promoting substance are classified and methods of synthesis and identification are discussed together with means of application. Numerous references to literature are included in the text and in lists at the ends of chapters, there being also an alphabetical index of authors. There is a tabular index of the plant growth substances mentioned in the book, which gives information on their solubilities and melting points in addition to the page references.

AN INTRODUCTION TO INDUSTRIAL MYCOLOGY. By George Smith, M.Sc., A.I.C. Pp. xii + 302, 8½ × 5½. (London: Edward Arnold & Co., Ltd., 1938.) Price 16*s*.

This book is written primarily for those concerned with a study of "moulds" from the practical point of view of their control in industry, and with this aim in view the author does not assume more than an elementary knowledge of botany on the part of his reader. The book serves its purpose excellently, and in addition it cannot fail to attract the trained mycologist by reason of the admirable photomicrographs which it contains. There are 130 of these, and in each case the precise magnification is given, so that they are comparable one with another.

After the two introductory chapters dealing in outline with

the classification of fungi the major part of the book is taken up with an account of the various groups of moulds and their industrial importance. Keys for the identification of species are given in the text.

The later chapters are devoted to the physiology of mould fungi, and the laboratory technique and apparatus required for their maintenance in artificial culture. Methods of controlling mould growth are also discussed, together with the industrial uses of fungi for such purposes as the ripening of cheeses and the manufacture of certain organic acids.

As a guide for more detailed study lists of references are included at the ends of the chapters, and there is a final chapter on mycological literature giving lists of books and periodicals likely to be useful.

VITAMINS AND VITAMIN DEFICIENCIES. By Leslie J. Harris, Ph.D., Sc.D., D.Sc., F.I.C. Vol. I. Introductory and Historical. Vitamin B_1 and Beri-beri. Pp. xiv + 204, 8 × 5½. (London: J. & A. Churchill, Ltd., 1938.) Price 8*s*. 6*d*.

This volume is the first of seven to be published on the subject of *Vitamins and Vitamin Deficiencies*. The general plan of publication will be to deal first with the water-soluble and then the fat-soluble group, but as work is less advanced on " the vitamin B_2 complex " and on certain " other unclassified factors," these have been transferred to the end of the series. The difficulty which the author has found with a subject which is developing so rapidly is that each time revision is undertaken the early chapters are found to be out of date before the end of the work has been reached, hence he has thought the best solution to be to issue the treatise in a number of separate sections, so that each section is as nearly as possible up to date when published.

The volume under review is divided into two parts, the first dealing with the historical aspect of the discovery of vitamins, their differentiation and nomenclature, and the second part with a consideration of vitamin B_1 and Beri-beri. The author has succeeded in compressing a very large amount of information into less than 200 pages of text, and the value of the work is still further enhanced by the extensive bibliography given at the end of the relevant chapters. Another pleasing feature is the comprehensive subject and author indexes, both of which are essential to a book of this type.

It is impossible in a short notice to deal adequately with the mass of information given in the book, but it can be said that this first volume indicates that the literature on vitamins will be usefully augmented by such a concise and efficient series of publications on this vast subject.

CHEMISTRY OF THE PROTEINS. By Dorothy Jordan Lloyd, M.A., D.Sc., F.I.C., and Agnes Shore, B.Sc., A.I.C. Second Edition. Pp. xi + 532, 8 × 5¼. (London : J. & A. Churchill, Ltd., 1938.) Price 21s.

Since the publication of the first edition of this valuable work developments in protein chemistry have provided a mass of new knowledge. As a consequence the present edition has been enlarged to almost twice the length of the original edition—notwithstanding the omission of the chapter on the industrial uses of the proteins. The general plan of the book has, however, been retained, the first part being devoted to the constitutional chemistry and the latter section to the physical chemistry of the proteins. Each chapter is followed by a long list of references which includes many papers which have appeared in biological journals.

The authors have made a careful and comprehensive survey of the literature on their subject and have presented a vast amount of information summarised in a clear and easily readable form. The book may be read and consulted confident that all that is significant in our knowledge of protein chemistry is to be found within its covers.

COMMERCIAL FRUIT AND VEGETABLE PRODUCTS. By W. V. Cruess. Second Edition. Pp. x + 798, 9 × 6. (London : McGraw-Hill Publishing Company, Ltd., 1938.) Price 36s.

A review of the first edition of this book appeared in this BULLETIN, 1924, **22**, 390-391. As the author points out in his preface to this new edition, since that date important advances have been made in the technology and underlying sciences of the industries in which fruits and vegetables are utilised. In addition, the freezing storage of vegetables and fruits has attained industrial importance, and the production of wines and other alcoholic fruit products has been legalised in the United States.

For these reasons it has been necessary completely to revise some chapters, such as those on vitamins, canned food spoilage, tomato products, and canning, and to add several new chapters, viz., those on plant pigments, enzymes of fruits and vegetables, freezing storage of fruits and vegetables, and the making of wines.

To those who are acquainted with the earlier work this revised and enlarged edition needs no recommendation. They must frequently have expressed the hope that Professor Cruess might find it possible to bring this much valued publication up to date. For others, a brief review can hardly do justice to the usefulness of the book, but the following list of subjects dealt with will serve to indicate to some extent its very wide

scope. There are thirty-four chapters relating to: micro-organisms in relation to fruit and vegetable products; general principles and methods; history of canning; containers; establishing a cannery; washing, blanching, and peeling; grading; syrups and brines used in canning; exhaust and vacuum; processing of canned fruits and vegetables; canning of fruits; pickling and canning of olives; canning of vegetables; spoiling of canned foods; unfermented fruit beverages; fruit and vegetable syrups; jellies and marmalades; fruit jams, butters, preserves, and confections; tomato products; sun drying of fruits; dehydration of fruits; dehydration of vegetables; vinegar manufacture; pickles; olive and coconut oils; utilisation of waste fruits and vegetables; citrus by-products; packing cases; wines; frozen-pack fruits and vegetables; vitamins; plant pigments and related compounds and enzymes of fruits and vegetables.

It will be appreciated that even in a work of nearly 800 pages it is not possible to deal comprehensively with each of such a large variety of subjects, but it can be safely said that all connected in any way with the fruit and vegetable products industry will find something of interest and value.

INSECTS OF CITRUS AND OTHER SUBTROPICAL FRUITS. By Henry J. Quale. Pp. ix + 583, 9 × 6. (Ithaca, New York: Comstock Publishing Company, Inc., 1938.) Price $5.00.

In addition to giving an account of the pests of citrus this book deals with insects and mites attacking the avocado, grape vine, walnut, almond, pecan, fig, olive, date, oriental persimmon, pomegranate, and sweet cherry. Except in the case of citrus crops and avocado the attention is largely confined to pests occurring in the United States, but for these crops the more important pests found in other parts of the world are also discussed. It will be noticed that the treatment includes mites attacking the various fruits, and there is one chapter dealing with other pests, such as rodents, nematodes and snails.

The opening chapter, which forms a general survey of the ground to be covered, gives a brief account of the various fruits, their distribution, and the principal pests attacking them; it contains also a key to the more important insect and mite pests of citrus in the United States. Three chapters are devoted to pests of citrus and there are nine dealing with those of other subtropical fruits. The accounts are excellently illustrated and include information on control measures and in some cases on insect predators and parasites attacking the pests. Further details on these points are contained in chapters specially devoted to fumigation, spraying and dusting, and insect predators and parasites. The final chapter is on the United States plant quarantine laws applying to the crops

considered. There are numerous references to literature given in the form of footnotes throughout the text, the names of authors being included in the general index.

THE PRINCIPLES OF CANE SUGAR MANUFACTURE. By J. G. Davies. Pp. viii + 144, $9\frac{1}{2} \times 6$. (London: Norman Rodger, 1938.) Price 10*s*.

The author of this book is the Sugar Technologist at the Imperial College of Tropical Agriculture, and the book is written for the non-technical reader who possesses very little or no knowledge of cane sugar manufacture.

The text deals chiefly with the process of manufacture of raw sugar and chemical control, only one chapter being devoted to the production of direct consumption sugars. The chapters dealing with raw sugar manufacture are divided into Juice Extraction, Steam Generation, Screening and Clarification, Subsidation, Filtration, Multiple Effect Evaporation, Crystallisation and Separation. Separate chapters at the end deal with Fancy Molasses, Transport, and the Utilisation of Factory By-Products.

Excellent features of the book are the explanatory flow-sheets of the various processes, and the photographs and sectional drawings of machinery used. These, combined with the reading matter, enable the reader without engineering knowledge to obtain a clear idea of the principles involved in sugar manufacture. As is to be expected, the author writes as one who knows his subject thoroughly, and he is to be congratulated on the clear and concise way in which he has presented his facts.

THE EXTRA PHARMACOPŒIA OF MARTINDALE. Volume II. Pp. xxxvi + 1148, $7 \times 4\frac{1}{2}$. Twenty-first Edition. Published by direction of the Council of the Pharmaceutical Society of Great Britain. (London: The Pharmaceutical Press, 1938.) Price 22*s*. 6*d*.

This publication is so well known and appreciated by pharmacists and chemists that it is sufficient here merely to draw attention to the many changes and additions in the new edition which will render the book of still greater value to its owner. There are over 250 more pages than in the previous edition caused partly by a greater use of the larger size of type and partly by the inclusion of new material.

The revision includes an enlargement of the "Analytical Addenda to Chemicals and Materia Medica" so as to include substances in the B.P. Addendum, U.S.P.XI, and the new French Pharmacopœia. The section on "Proprietary Medicines," now much increased in size, is removed from the end of the book to a place next to the analytical addenda. The

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(January - March, 1939).

CORRIGENDA.

Page 88, line 22, *for* Two *read* Three.

,, 88, ,, 3 from bottom, *for* (Nos. 1, 2 & 3), *read* (Nos. 1, 2, 3 & 4)

,, 91, ,, 27, *for* Oil Shale, *read* Limestone.

,, 97, ,, 8, *for* 14 *read* 16, *and for* 28,000 *read* 29,000.

,, ,, ,, 16, *for* 11,000, *read* 1,000.

,, ,, ,, 28, *for* cable, *read* rotary.

,, ,, ,, 2 from bottom, *for* Omskirk, *read* Ormskirk.

,, 98, ,, 23, *for* are now being, *read* have been.

,, ,, ,, 31, *for* magnetic, *read* seismic.

Table, page 99, Eskdale No. 1, column 4, *for* Upper Jurassic, *read* Upper Lias.

,, ,, ,, Cousland No. 1, column 6, *for* 2694, *read* 2094.

,, ,, 101, Poxwell No. 3, column 4, *for* Purbeck—Gault, *read* Upper Greensand—Purbeck.

,, ,, 102, Coalport G.1, column 4, *for* Permian, *read* Upper Carboniferous.

,, ,, ,, Coalport G.2, column 4, *for* Permian, *read* Lower Trias.

,, ,, ,, Coalport G.3, column 4, *for* Permian, *read* Upper Carboniferous.

table of " Corroborative Tests " has been completely reconstructed while the chapters on " Hydrogen Ion Concentration " and on " Nutrition " have both been enlarged. There are also additions to many of the other chapters including those on " Sterilisation " and " Disinfectants," while the sections on " Microchemical Analysis," " Fluorescence Analysis " and " Chromatographic Analysis " have assumed positions of greater importance. This edition also contains an entirely new and useful section on " The Nomenclature of Organic Compounds " which should assist users of the " Extra Pharmacopœia " to understand more fully the structure of the organic compounds they handle.

This edition, with its well-arranged glossaries and index, continues the high standard expected of the " Extra Pharmacopœia."

A TEXT-BOOK OF PHARMACOGNOSY. By George Edward Trease, B.Pharm., Ph.C., A.I.C., F.L.S. Third Edition. Pp. x + 739, 8½ × 5½. (London: Baillière, Tindall and Cox, 1938.) Price 21s.

This text-book, which has already proved a most useful work both for study and reference purposes, now appears in its third edition. There have been considerable additions to the text and illustrations and the subject matter is rearranged into five sections dealing with general principles, microscopy, drugs of vegetable origin, drugs of animal origin, and physical and chemical methods of analyses. The section on microscopy consists largely of new material; it is made up of five chapters and includes tables giving the microscopical characteristics of a number of powdered drugs.

The bulk of the book is taken up by the section on vegetable drugs, which is illustrated with numerous excellent photographs and drawings. The descriptions are arranged under the plant families of the drugs and include some account of the source of each article, its characters, constituents and uses. Animal drugs receive similar treatment.

The final section of the book contains an interesting account of fluorescence analysis and a new chapter on the technique of drug evaluation, written with the collaboration of Mr. H. O. Meek. Contributions to other parts of the book have been made by Dr. R. Bienfang, Mr. W. R. Heading, Mr. H. M. Hirst, and Mr. A. H. Ware.

There are two appendices, the one giving maps to show the regions in which the various drugs are collected, and the other a glossary of Latin words used in the specific names of plants. It is a pity, however, that the common English names of a number of drugs have been omitted from the index.

SHOE CREAMS AND POLISHING WAXES. By Dr. J. Davidsohn and A. Davidsohn. Pp. x + 142, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: Leonard Hill, Ltd.). Price 10s.

The matter in this book is divided into two parts. In Part I, which consists of five chapters, the salient features of the raw materials entering into the composition of the final product are described. These include the waxes and wax-like substances, both natural and synthetic, which form the basis of the polish, the alkaline materials employed in the manufacture of water-containing and half saponified polishes, and the solvents most frequently employed for the latter and water-free polishes. Simple methods of testing the waxes and solvents are included in this part.

Part II, in four chapters, deals with the actual manufacture of shoe creams and polishing waxes in some detail, consideration being given to machinery required for all types of polish, the choice of wax and solvent, colouring of the product, filling of containers, with the best filling temperatures, and possible faults in the finished product, with the means for eradicating them. A large number of very useful recipes for polishes of various kinds is given in this part, and finally the simple testing of shoe creams and wax polishes is described.

It is evident from a perusal of the book that the authors are well acquainted with the materials and manufacturing processes entering into the production of the polishes under consideration, and, in spite of the unusual phraseology and non-idiomatic English employed throughout the book, they are to be congratulated in making their knowledge available in such a compact form. It can truly be stated that the aim of the book as given in the authors' preface, "to give the necessary knowledge, particularly to the practical man, which will qualify him to avoid, or to overcome easily, difficulties in the selection of raw materials or in the course of manufacture," has been fully realised.

WERWERTUNG DES WERTLOSEN. Edited by Dr. Claus Ungewitter with the collaboration of Dr. W. Greiling, Dr. W. Koeck and Dr. E. Barth von Wehrenalp. Pp. 304, $8\frac{1}{2} \times 5\frac{3}{4}$. (Berlin: Wilhelm Limpert, 1938.) Price, paper covers, 6.80 R.M., linen bound, 7.80 R.M.

This is a book about making the best of things, in the material sense, or in other words the profitable employment of "waste" or hitherto unused substances. The subjects covered range from the atmosphere as a source of agricultural nitrogen and rare gases to the vast potential riches (animal, vegetable and mineral) of the sea, and from the resources of the mine, the forest and the farm to the utilisation of the

by-products of chemical industries and that of town waste and sewage. These problems have always been of interest to chemists, and in recent years they have been an object of intensive study in Germany. Many of them have been solved, and some remain to be solved.

A particularly interesting chapter is devoted to the hitherto untapped possibilities of wealth in coal ash, of which ten million tons are produced annually in Germany. This, we learn, contains 2·7 kilos per ton of cobalt, nickel, molybdenum, chromium and vanadium ; 19 kilos per ton of tin, zinc, lead and arsenic ; 6 grams per ton of gold, platinum, palladium and silver ; and 7 kilos per ton of rare metals. It is estimated that, assuming only a fifty per cent. recovery of these metals, they represent a value of 60 R.M. per ton of coal ash, and it is suggested that of the total production of coal ash in Germany one quarter, that is 2·5 million tons per annum, might be made available for treatment.

The book is not written in the manner of a technical work of reference, but aims rather at presenting the subject as a question of political economy in a manner intelligible and attractive to the general reader, and this aim appears to have been well achieved.

Much of the matter in the book has already appeared in the journal *Die Chemische Industrie.*

CHEMIE EROBERT DIE WELT. By Walter Greiling. Pp. 394, $8\frac{1}{2} \times 5\frac{3}{4}$. (Berlin : Wilhelm Limpert, 1938.) Price 7.50 RM.

This volume is a survey of the achievements of chemistry in the conquest of nature as a factor in economic advancement.

Beginning with the foundations of industrial chemistry laid by such men as Leblanc in France and Roebuck and Muspratt in England, and following through all its subsequent developments the superstructure built up largely by German chemists, it leads up to the great combines that rule the world of chemical industry to-day with their interlocking arrangements for pooling research and directing sales.

Among the most interesting chapters in the book is that entitled " Amerika oder Deutschland ? — Chemie des Überflusses oder Chemie der Mangelseite ? " in which comparison is drawn between problems in the United States where there is a superabundance of raw materials and Germany where the opposite is the case. In this latter connection another German publication reviewed above is of particular interest.

The book is illustrated by a large number of photographs, which add greatly to its attractiveness.

BOOKS RECEIVED FOR REVIEW

AN INTRODUCTION TO BOTANY. By Arthur W. Haupt. Pp. xii + 396, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1938.) Price 18*s*.

PLANT PHYSIOLOGY. By Edwin C. Miller, Ph.D. Second Edition. Pp. xxxi + 1201, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1938.) Price 45*s*.

PLANT INJECTION FOR DIAGNOSTIC AND CURATIVE PURPOSES. By W. A. Roach, D.Sc., A.R.C.S., D.I.C., A.I.C. *Imperial Bureau of Horticulture and Plantation Crops, Technical Communication No.* 10. Pp. 78, 9¾ × 7¼. (East Malling, Kent: Imperial Bureau of Horticulture and Plantation Crops, 1938.) Price 5*s*.

THE GENETICS OF GARDEN PLANTS. By M. B. Crane and W. J. C. Lawrence. Second Edition. Pp. xxi + 287, 8¾ × 5¾. (London: Macmillan & Co., Ltd., 1938.) Price 12*s*. 6*d*.

THE CHEMICAL ANALYSIS OF FOODS AND FOOD PRODUCTS. By Morris B. Jacobs, Ph.D. Pp. xxii + 537, 9 × 6. (London: Macmillan & Co., Ltd., 1938.) Price 25*s*.

CONTRIBUTION À L'ÉTUDE CHIMIQUE DES LÉGUMINEUSES INSECTICIDES DU CONGO BELGE. By E. Castagne. Pp. 102, 10 × 6½. (Brussels: Librairie Falk fils, Georges van Campenhout, Successeur, 1938.) Price Fr. 45.

PROCESSES AND MACHINERY IN THE PLASTICS INDUSTRY. By Kurt Brandenburger. Pp. xii + 243, 8½ × 5½. (London: Sir Isaac Pitman & Sons, Ltd., 1938.) Price 25*s*.

THE NORTH AMERICAN ASSAULT ON THE CANADIAN FOREST. By A. R. M. Lower, W. A. Carrothers and S. A. Saunders. Pp. xxvii + 377, 9¾ × 6½. (Toronto: The Ryerson Press; New Haven: Yale University Press; London: Humphrey Milford, Oxford University Press, 1938.) Price 16*s*.

AN INTRODUCTION TO AMERICAN FORESTRY. By Shirley Walter Allen. Pp. viii + 402, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1938.) Price 21*s*.

LUMBER. ITS MANUFACTURE AND DISTRIBUTION. By Ralph Clement Bryant, F.E., M.A., Sc.D. Second Edition. Pp. xxiv + 535, 9 × 6. (New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1938.) Price 25*s*.

CATALOGUE OF LEWIS'S MEDICAL AND SCIENTIFIC LENDING LIBRARY. Part I. Authors and Titles. New Edition, revised to the end of 1937. Pp. 8 + 550, 8¼ × 5¼. (London: H. K. Lewis & Co., Ltd., 1938.) Price 16*s*.

JUSTUS VON LIEBIG. Die Lebensgeschichte eines Chemikers. By Richard Blunck. Pp. 319, 8½ × 5½. (Berlin: Verlag Wilhelm Limpert, 1938.) Price RM. 7.50.

MINERAL RESOURCES

ARTICLES

MINERAL STATISTICS

By G. H. Tipper, M.A., M.I.M.M., F.G.S.
Minerals Adviser to the High Commissioner for India

It is unnecessary at the present time to stress the importance of the mineral and metal trade in any of its aspects. It is sufficient to draw attention to its world-wide international character and to its great economic importance to the producing and consuming countries.

The ramifications of this trade cannot, however, be adequately appreciated without statistics, and all those interested owe a debt of gratitude to the Imperial Institute for what is known briefly as the "Statistical Summary." First published in 1921 by the Imperial Mineral Resources Bureau, it has grown from a small brochure of 99 pages of tables dealing with 39 minerals to an imposing volume of 424 pages of tabular matter relating to 54 minerals.

The growth in this statistical volume is evidence of the desire of the staff of the Imperial Institute to make the publication as complete as possible an account of the mineral industry, and it is universally recognised as one of the most important compilations available, and is a monument to the industry and knowledge of the statistical and mineral departments.

A study of the tables and a glance at the list of publications consulted show the very variable character of the information made use of and that for the basic figure on which to build accurate statistics, i.e. of production, there is no agreed definition. It is by no means easy to define production in simple terms which will cover all minerals, metallic and non-metallic.

With metallic ores it is the recoverable metal or metals which is of importance and it may be argued that the actual recovery from the smelter, furnace or refinery, is the real

production figure. It is true that in countries where industrial activity is high, or where there are complete refining facilities, such representative production figures might be available, but returns of this kind would not be applicable to countries from which ores and concentrates are exported for treatment elsewhere. In the latter cases it would be necessary to know the metallic contents of the exported material. It would be preferable to retain mine production as a separate feature, and the following data would seem adequate to cover all metallic ores, simple and complex, used for the extraction of metals, viz., the number of tons of saleable ore raised from the mine together with an analysis showing the percentages of the metals contained therein, or in the case of precious metals the number of pennyweights or ounces per ton.

Although such returns are apparently applicable to production from mines, they do not include recovery of metals and metallic ores from an important source, viz., dredging. In this case concentration is an integral part of the process and no useful purpose would be served by attempting to alter the returns as at present given, but it would be advantageous to have such separated from the figures for mine production.

In general, non-metallic minerals require some form of treatment before they are saleable. Mica, for example, undergoes an elaborate process of trimming, sizing, grading and sorting before being put on the market as block, while the smaller sizes are converted into splittings. The waste obtained can be utilised for powdered mica. Manganese ore, for which a gross figure of production is given, can be classified as battery and chemical ore depending on the amount of available oxygen ; ferro-grade manganese ore, covered by stringent specification ; second grade ore used so largely in the basic iron and steel process ; and so on. Chromite, in addition to its metallurgical uses, is a valuable refractory material. In these and similar cases comprehensive production figures are inadequate and do not give the information necessary to follow the ramifications of the trade. The difficulty would be met if it were possible to specify the different grades of material produced from the mine or quarry.

Production figures cover only one aspect of the trade. There are the exports and imports to be considered and in these confusion often arises. Some years ago there appeared in the Customs Returns for India a cryptic entry of the export of

"dog metal." On referring the matter to the Indian authorities it was eventually discovered that the material was kyanite and that the name had been bestowed because bits of the mineral were used to drive away the dogs from the exporter's camp. In certain cases cheaper freight rates for one commodity can be used to cover another material, e.g., the export of red ochres as iron ores; the inclusion under one heading of another grade of the same mineral. During recent years the figures for the export of waste mica under the heading "splittings" from India has lead to undue inflation of the figures for the latter and a misunderstanding of the trend of trade. Naturally the authorities reporting exports are not entirely responsible for any confusion which exists. They can only accept the information given to them and can hardly be expected to attempt any reforms on their own account. The onus rests to a great extent on the exporter.

Import figures may also reveal confusion and in certain cases definite lacunæ. In the imports into the United Kingdom a combined figure for ilmenite and zircon (titanium ore and zirconium ore) is given. It would be difficult to find a more confusing combination. It is well known that Canada is one of the most important producers of the platinum metals and of concentrates containing these, and that a considerable proportion are imported into the United Kingdom for refining purposes, yet such an important item of trade receives no mention in the returns.

The Statistical Summary does not attempt to estimate consumption. On the ordinary formula of production plus imports less exports the figures provided give a basis for calculating the apparent consumption in any one country. Apparent consumption is a misleading figure as it does not take into consideration consumer's stocks, but over a series of years it is probable that it will approximate to industrial consumption. With the advent of restriction schemes, compulsory and voluntary, designed to co-ordinate production and consumption, the matter has become one of considerable importance. Great opportunities exist under these schemes for collecting statistical data, and the information obtained is as complete as it can be made, although limited in scope. That it is not sufficiently complete for the purpose is obvious from the rapidity with which quotas have been altered.

In the above very brief account concerned chiefly with the statistical work of the Imperial Institute and some of the difficulties encountered, as they strike an outsider, an attempt is made to define production to cover all minerals, metallic and non-metallic. This definition confines itself to the mine or quarry and is not concerned with smelter or refinery products, important as these may be. No doubt cogent arguments can be produced in modification, but the main object of writing is to stimulate, if possible, consideration of the best way of reporting mineral statistics and their improvement.

It is well known that the matter has been considered by other bodies including the Conference of Empire Statisticians held at Ottawa in 1935. This body left the whole in the air and referred the question back to the Imperial Institute. The fact is that this is not entirely a statistical problem, but is one which can only be solved with the co-operation of mining companies, quarry owners and others directly interested in mineral production.

The Empire as a whole is deeply interested in the mineral trade and the adoption of a uniform system of reporting production and other mineral figures would be of great value.

THE BRITISH PETROLEUM DRILLING CAMPAIGN

Two years have now elapsed since the latest search for oil in Great Britain was initiated at Portsdown by the D'Arcy Exploration Co., Ltd., and reference has already been made in this BULLETIN (1936, **34**, 241, and 1937, **35**, 478) to the earlier work of this Company, as well as that of the Anglo-American Oil Co., Ltd., Messrs. Steel Bros. & Co., Ltd., and the Gulf Exploration Co. (Great Britain), Ltd., who are also engaged in the survey. In the period to the end of 1937, five major drilling tests were virtually completed, namely, the Portsdown, Henfield, Kingsclere and Eskdale No. 1 borings of the D'Arcy Company, and the Grove Hill operation of the Anglo-American concern; these bores, together with the shallower holes made by the former at Broad Bench in Kimmeridge Bay, at Poxwell (Nos. 1, 2 and 3) near Weymouth, and at Ringstead Bay, and by the Gulf Exploration Company at Rainham and Bredhurst, represent approximately 5 miles of drilling.

The position at the beginning of 1938 was one in which the Kingsclere undertaking, near Newbury, Hampshire (drilling with the plant from the Portsdown site), was completed, the bit having reached the Trias at 5,060 ft., without disclosing signs of either gas or oil, though bituminous shales were encountered in the Purbeck beds, Kimmeridge, and Oxford clays. The hole was not devoid of interest, however, as the Jurassic proved to be of great thickness and to carry several zones of poor grade ironstone, one of which in the base of the Inferior Oolite at a depth of 3,653 ft. was 144 ft. thick. Arrangements were made to transfer the rig and diesel equipment to a site at Gun Hill, three miles north of Leek in Staffordshire.

In north-east Yorkshire, on the high moors stretching inland from Whitby, the Eskdale No.1 drilling to test a meridional anticline in the Permian which was here believed to be beneath 4,000 ft. of Liassic and Triassic cover, met with a dismaying chapter of accidents owing to a chilled steel bit fracturing at the bottom of the hole on Thursday, November 25, 1937, when progress had been made down to 2,486 ft. Fishing operations were continued until the latter part of February of the following year but without success, and attention was turned to side-tracking the hole.

In Derbyshire the drilling licence held by the Duke of Devonshire for the Hardstoft area, which was tested by the three holes put down by Messrs. Pearson & Sons in the period 1918-1922, was transferred to the D'Arcy Company and preparations were being made to deepen the No.1 well which up to the end of 1937 had yielded almost 3,000 tons of crude oil.

The Scottish operations of both the D'Arcy and Anglo-American companies in Midlothian were well under way at the New Year, but Messrs. Steel Bros'. drilling at Upper Booth was making slow progress, and the Gulf Exploration Company had not publicly announced a choice of site for a large-scale drilling test.

The subsequent developments have proved to be not entirely without good fortune in Scotland but barren of economic reward in England.

Scotland

The oil-bearing properties of the Scottish Lower Carboniferous shales in Midlothian attracted the attention of the

earlier petroleum investigators, and once more the D'Arcy-Cousland anticline, which lies eastwards of Edinburgh and extends from Gorebridge to Prestonpans, a distance of 9 miles, is being tested.

Choice of this structure rather than those to the west at Pumpherston, Broxburn and elsewhere rested upon its relative freedom from the major faulting characteristic of the main shale-oil area, and the promising marginal closure of the oil-shale group of sediments. In addition, the old D'Arcy well located at a site on the ridge had yielded petroleum, whereas the West Calder boring in the extreme south-west of the oil-shale area had penetrated almost 4,000 ft. of strata without meeting oil. Oil seepages around Liberton, south-east of Edinburgh, near the Pentland Fault, and an oil-impregnated sandstone at Straiton about 2 miles to the south, were further factors establishing the validity of the selection.

An interesting comparison made by the Anglo-Iranian Research Laboratory of oil from the old D'Arcy well and of a sample from the Dunnet mine, obviously generated by the intrusion of an igneous sill into the oil-shale, revealed a marked similarity. Since the entire district is ramified by dolerite and teschenite sills many of which come into intimate contact with the oil-shales, large quantities of free oil must have been generated at various times, but the marine sediments present in the north-eastern locality gave rise to hopes of the generation of petroleum directly from marine sapropels without the intervention of igneous activity.

The ridge was surveyed by the *D'Arcy Exploration Company* and a structural contour map prepared by Dr. Allison from the Geological Survey 6-in. records revealed the presence of three anticlinal maxima at D'Arcy, Cousland and Carberry Hill respectively. The company, as previously indicated, selected the Cousland site for test and at the beginning of 1938 the drilling was down into the Oil Shale group, having started in Limestone No. 2 of Tyne Water, Midlothian. As a result of the work five natural gas-bearing sands were revealed, one of which between 1,720 and 1,807 ft. yielded on test a supply flowing at the rate of 6,250,000 cu. ft. a day, and a second between 1,582 and 1,640 ft. appeared capable of flowing at over 4,000,000 cu. ft. daily. Partial tests made on the sands indicated that a supply of dry gas much in excess of 10 million

cu. ft. per day was quite a possibility. A small show of oil was encountered between 1,248 and 1,275 ft. The well was completed in the early part of September 1938, at 2,917 ft., having traversed all the potential oil-bearing zones of the Lower Carboniferous, but was not abandoned, being sealed so as to permit of its use as a gas-producer should the occasion arise.

The extensive quantity of gas available and certain geological considerations made it appear certain that the No.1 site was actually on the crest of the anticline, and in July the Company declared its intention of testing the structure at a lower level from which a more positive supply of oil might reasonably be expected. Accordingly a new site (Cousland No.2) was selected about half a mile west of the Cousland No.1, and 200 to 300 ft. down the flank, to which the drilling equipment from the first undertaking was transferred in October of last year. This boring has reached a depth of 1,878 ft. in the Oil Shale series.

Attention was also turned to the northerly part of the area and a series of three scout borings, referred to as Cousland Nos. G.1, G.2 and G.3, were made for geological information between the end of September and the beginning of November. These drillings attained depths of 325, 162 and 354 ft. respectively and the work was of material assistance in the selection of yet a third location for a major operation. This new boring site (Cousland No.3) was finally fixed at a point some 2 miles north of Cousland No.1, and drilling was begun in March 1939 and is now down to 118 ft. in the Oil Shale strata.

Geological investigatory drilling is also being carried out by the Company north of Kirkcaldy on the opposite shore of the Firth of Forth where the oil-shales and lavas of the Calciferous Sandstone series rapidly thin out but an especially strong development of estuarine beds is present which may presage favourable conditions for oil generation. Between the end of October 1938 and the middle of January 1939 four borings had been made near Balfour with a portable rig 28 ft. high and mounted on a six-wheeled Ford truck, the engine of which furnishes the motive power for the drilling rods. These holes are referred to as the Balfour drillings, Nos. G.1, G.2, G.3 and G.4 and reached depths of 678, 924, 670 and 520 ft. respectively; the information obtained will be employed in deciding a site for a major drilling test on the north side of the Forth.

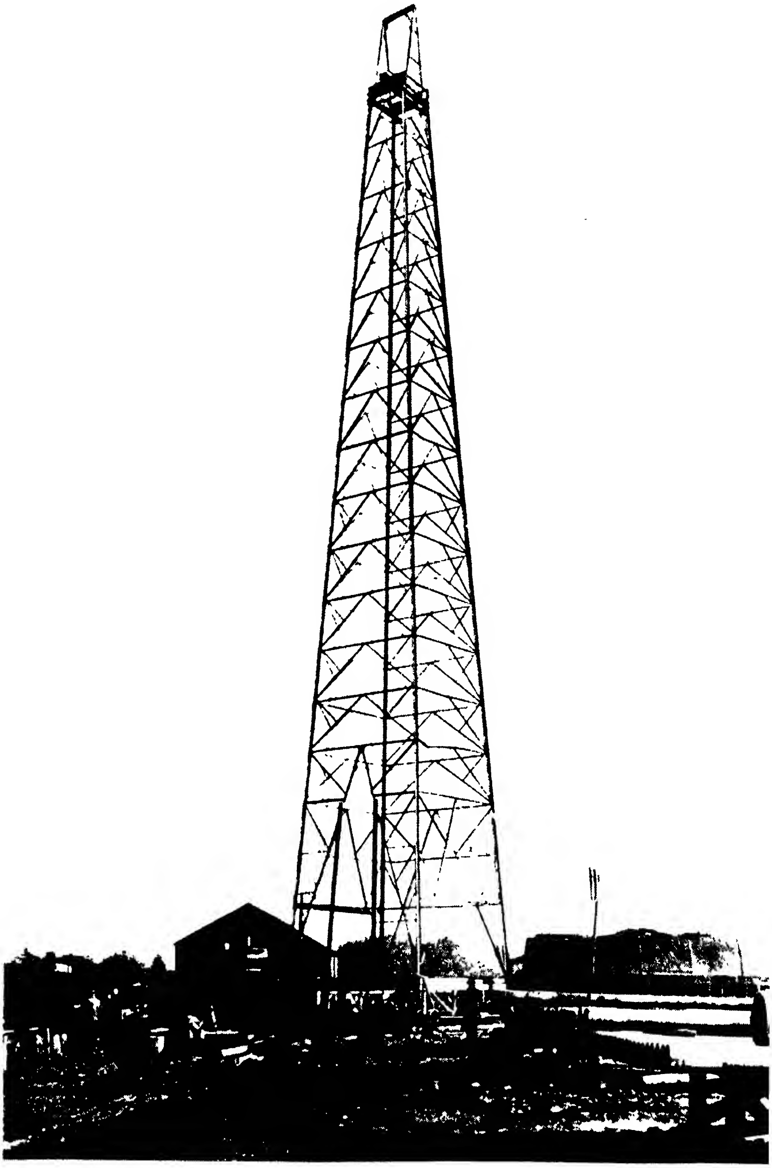
Exploratory work on the Pentland Fault, which has an approximately N.E.-S.W. trend from Portobello on the southern shore of the Forth and brings the Upper Oil Shale group alongside the Lower Oil Shale group and further south against the Upper Old Red Sandstone, was begun in January 1939 south-east of Liberton, where oil seepages are known to occur, particularly at St. Catherine's Well almost on the Fault. To date three drillings have been carried out, Pentland Nos. G.1, G.2 and G.3 which have proceeded to depths of 534, 70 and 260 ft.

The *Anglo-American Oil Co., Ltd.*, after completing the Grove Hill trial at Hellingly, Sussex, transferred the equipment to the licence area on the D'Arcy-Cousland anticline, previously selected by Mr. Cunningham Craig for the Midlothian Petroleum Syndicate.

Actual drilling began at D'Arcy Farm on Saturday, October 30, 1937, and proceeded uneventfully, though several oil and bitumen-impregnated sandstones were encountered, until the bit entered the Devonian series and was checked at 3,857 ft. A return was then made to the oil-bearing horizons, the most promising of which lay between 1,733 and 1,760 ft., which were surveyed by the Schlumberger method of electrical logging. The liners having been withdrawn for this survey, it was decided to plug the hole between 1,811 and 1,850 ft. and enlarge its upper diameter from 9 to 13 in. These operations were duly accomplished and a casing set down to 1,700 ft. to enable a test being made of the selected oil horizon. After removing the drilling-mud cake, swabbing of the bore walls was commenced, and on Monday morning, June 27, drops of crude oil were observed to be issuing with the water and a gas-pressure developed in the casing. This swabbing was continued until the water level in the hole fell to 1,100 ft. when the gas pressure exceeded the hydrostatic head and the well blew out. The gas-flow was permitted full egress for a short time, then the hole was swabbed and yielded a few gallons of an emulsion of oil and water. Subsequently the proportion of oil in the emulsion swabbed out rose, and in the first 24 hours 15 barrels of emulsion were obtained. Swabbing operations continued to yield a supply of emulsion, but it was decided to open up the oil horizon still further by blasting. Arrangements for this work were made with Imperial Chemical Industries, Ltd., and a 22 ft. canister containing 450 lb. of

PLATE I

BRITISH PETROLEUM DRILLING CAMPAIGN.



[By courtesy of Anglo American Oil Co., Ltd.

MOVING A 126-FT. DERRICK AT D'ARCY FARM.

facing page 93.]

blasting gelignite and 50 lb. of dynamite was set below 1,731 ft. with a stemming of 250 ft. of fine gravel. The charge was detonated in the evening of Thursday, July 14, and the earth tremor was evident within a ½ mile radius of the well. Subsequent swabbing after the hole had been cleaned and re-lined yielded 59 barrels of clean oil in 9 days. Lower horizons between 2,050 and 2,150 ft. were tested in September 1938, and a sand at 2,065 to 2,085 ft. was proved to be capable of yielding several million cu. ft. of gas daily. In a 24-hour test an actual gas supply of 4 million cu. ft. was obtained at a pressure of 720 lb. per sq. in.

The well, Britain's latest oil-producer, and the first of the new campaign, was recompleted to the 1,733-1,760 ft. horizon and pumping equipment installed in January 1939. The present rate of production is between 350 and 500 gals. per day, accompanied by about 10,000 cu. ft. of gas. A total supply of 1,042 barrels has so far been obtained, the crude oil having a specific gravity of 0·823 at 15·5° C. and yielding over 10 per cent. of petrol on distillation. The oil is to be treated at a special still at the Company's Purfleet refinery in Essex.

The high measure of success attained at D'Arcy Farm was, no doubt, the deciding factor in the choice of a second site about 800 yds. north-north-west of Midlothian No.1, to be known as Midlothian No.2. Drilling began early in November of last year, and has been completed at a depth of 2,942 ft.

A third location some 660 ft. to the east of the No.1 well was agreed upon earlier this year, and a unique feat for this country was performed in March when the 126 ft. derrick weighing 30 tons was transported *en bloc* from the No.1 to the No.3 site. The task was accomplished by jacking up the structure from its concrete supports, transferring the load to four-wheeled bogies and hauling it by motor wagon across a field over a track formed of iron plates. The entire job was completed within a week, and included the awkward operation of slewing the piece round a boiler house which barred a straight run to the new area.

North-East Yorkshire

As yet, deep drilling in this part of the country has been undertaken only by the *D'Arcy Company*, but survey work both by means of shallow drilling and geophysical methods is being carried out by the Gulf Exploration Company.

The earliest effort of the former concern to test the Eskdale structure west of Whitby, as has already been stated, was terminated by a bit-fracture at 2,486 ft. After many unsuccessful attempts to recover the part, recourse was had to sidetracking the hole from 1,959 ft. after plugging at that depth. Work on sidetracking a new hole by means of a whip-stock began in February 1938, but towards the end of March the tools re-entered the old hole at 2,158 ft. and sidetracking recommenced from 2,071 ft. This effort failed after two or three weeks' drilling, when the first boring was entered at 2,189 ft., and a third trial was started from 1,846 ft. Again failure resulted, the bit making a re-entry almost immediately, and the third hole was filled back to 1,858 ft., but finally abandoned in May.

A new site was chosen known as Eskdale No.2, lying about 130 ft. to the east of the No.1 boring, and drilling commenced on June 15. This operation, like the first, started in the Lias, and was set with 15 in. casing down to 1,254 ft. when the bit was in the Rhaetic. At 1,256 ft. the Trias was encountered and proved to continue down to 3,640 ft., where the salt-bearing facies marking the top of Permian was met. The Permian magnesian limestone came in at 4,196 ft. and has not been passed through at 4,260 ft. A strong show of gas was encountered at the top of the Permian limestone.

The *Gulf Exploration Company* has done an extensive amount of geophysical work with the gravimeter and seismograph on the structures located on the northern and north-western flanks of the Cleveland Hills. At least 11 holes have been drilled ranging from 100 to 750 ft. in depth and recourse has been had to further geophysical surveying. The end in view is, of course, the location of a site for a deep test.

Midlands

The oil possibilities of the Lower Carboniferous strata at the southern end of the Pennine Chain, where a suitable closure is afforded the limestones by Coal Measures shales, and a series of favourable digitating anticlines has been developed, are well known, since shows of oil have been encountered in many of the coal mines in the local fields.

Interest centres around the Hardstoft area where the Pearson well, sunk in 1919, struck oil on June 3 of that year. The well is situated on the Duke of Devonshire's property,

about 7 miles south-east of Chesterfield, and is drilled into the Hardstoft anticline, a crest maximum on an anticlinal feature which pursues a sinuous course round the north-eastern side of Chesterfield southward to a position south-west of Mansfield. This feature was extensively tested at the time of the Hardstoft boring, as were the Ridgeways anticline running parallel to the northern section, and the Riddings fold to the south, and, in all, six holes were drilled having a total depth of 21,946 ft., five of which gave promising shows of oil or gas.

Such positive indications, especially at Hardstoft, attracted great attention in the new survey, and the *D'Arcy Company* were successful in arranging for the transfer to themselves of the licence held by the Duke of Devonshire, with the object of conditioning and deepening the Hardstoft well. Work began in January 1938, and after much time had been spent in withdrawing the old liners and setting a new casing, actual drilling was commenced early in September of the same year and advanced only as deep as 3,272 ft. in that month when edge water was struck which brought operations to an untimely conclusion. The well has subsequently been subjected to solvent and acid treatments and Schlumberger gun discharges in which over a thousand shots were fired with the object of promoting porosity in the limestone and increasing the oil yield. A great improvement in the oil yield has resulted.

The south-western flank of the Pennine terminal structure is also being tested near Leek in Staffordshire. The actual site selected by the D'Arcy concern is on Gun Hill, a location on a strongly-developed anticlinal fold of Lower Carboniferous limestones capped by the Millstone Grit sediments. The drilling rig employed was that previously used at Kingsclere in Sussex, and was started up on April 15, 1938, in the Grit series. Lower Carboniferous limestones and shales were encountered at 850 ft. approximately, the Lower Carboniferous Limestone at 1,535 ft., and a succession of limestones and subordinate shales was traversed down to 4,629 ft., at which depth work was terminated and the hole plugged. No satisfactory indications of oil were found in the main limestone and the effort must be classed as another dry hole.

In the eastern Midlands the Palaeozoic strata lie buried at varying depths beneath a cover of Permian, Triassic and later sediments, and in the past several borings, principally coal seam

trials, have been into the Carboniferous which is also considered the only likely oil-bearing formation. In particular a trial made in 1908 at Kelham only a mile or so west of Newark revealed the presence of oil in the Millstone Grit series issuing from a coarse conglomerate at 2,452 ft. The bore ended in the Carboniferous Limestone at 2,619 ft. At a later date a boring at Kirklington about 8 miles west of Newark gave a gas-show at 1,911 ft., and another at Farnsfield (No.3) 2 miles further west yielded gas with indications of oil at 2,427 ft. In 1923 a second boring was made about 200 yds. north of that at Kelham mentioned above, and gave similar results including shows of gas and oil, but no positive production. It is an interesting fact that two of these holes encountered an igneous sill of teschenitic affinity; in the Kelham bores it was present between 1,715 ft. and 1,793 ft., and in the Kirklington from 2,307 ft. to 2,358 ft. and again from 2,382 ft. to 2,400 ft., at which depth boring ceased. The Farnsfield No.3 boring failed to disclose the sill.

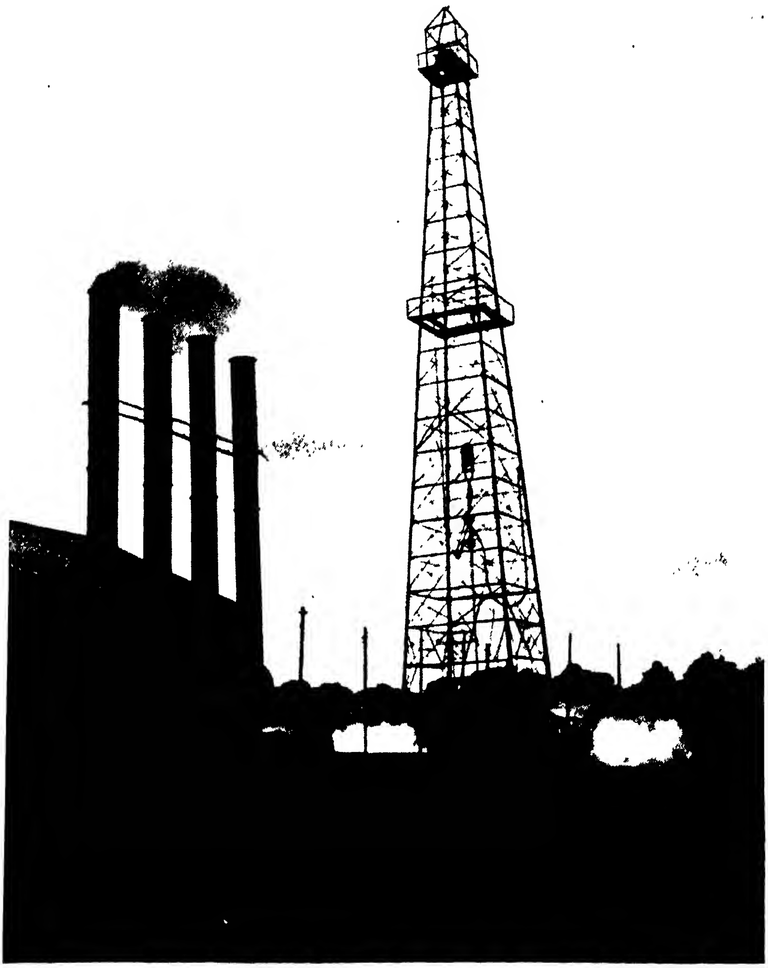
Other drillings made in the early years of the century appeared to show the presence of a roughly north-south ridge in the Carboniferous through Ollerton and a point some miles west of Newark, and recent prolonged geological and geophysical work by the D'Arcy Company has confirmed and delineated this structure.

At the beginning of this year a deep test location was decided upon at Eakring, south-east of Sherwood Forest, between Ollerton and the approximately east-west line of the Kelham, Kirklington and Farnsfield No.3 borings. The area is held under lease by the Stanton Iron Works Co. Ltd., and arrangements have been made to advise that concern of all coal seams encountered in drilling.

The Edale Valley, which pursues a west to east course immediately south of the Peak in Derbyshire, possesses several oil and gas shows in the bullions of the Edale Shales, strata attributed to the Upper Carboniferous period. *Messrs. Steel Bros. & Co., Ltd.*, hold a drilling licence covering this area and commenced drilling on September 27, 1937, with the object of testing the Mountain Limestone. The plant employed was capable of reaching a depth of 2,500 ft., though the limestone was expected to come in at about 1,000 ft. At 757 ft. a depth attained in April, 1938, a strong flow of water was encountered and the hole was finally abandoned at that depth in October.

PLATE II

BRITISH PETROLEUM DRILLING CAMPAIGN.



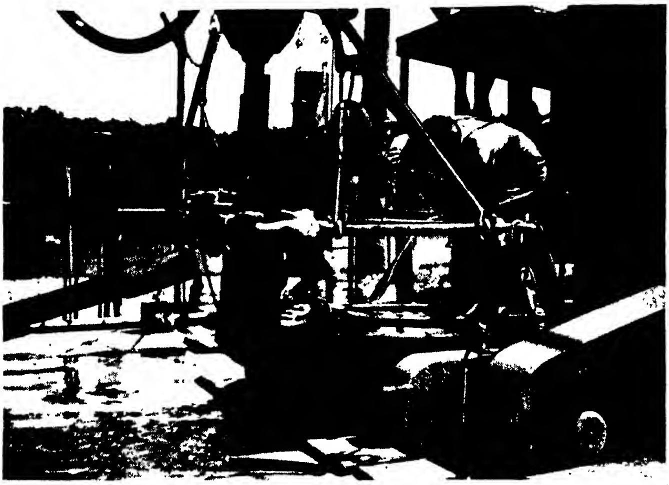
[By courtesy of "Petroleum Times."

DRILLING AT PENSHURST.

[facing page 96

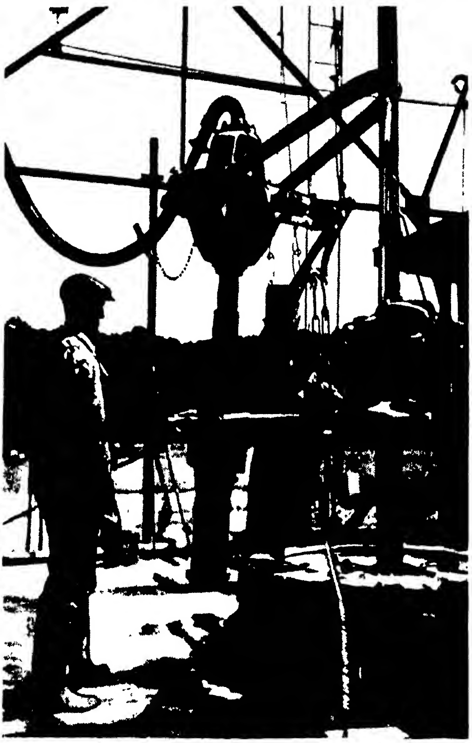
PLATE III

BRITISH PETROLEUM DRILLING CAMPAIGN.



[*By courtesy of "Petroleum Times."*

FIG. 1 DRILLING BIT ENTERING BORE HOLE.



[*By courtesy of "Petroleum Times."*

FIG. 2 -RUNNING IN DRILLING STEMS.

acing page 97.]

South of England

The efforts of both the Anglo-American Oil Company and the D'Arcy Exploration Company were virtually at an end in the closing weeks of 1937, though the latter subsequently carried out a brief survey of Chaldon Down situated north-west of Lulworth Cove. In the aggregate the drilling work performed throughout the southern area consisted of 4 major tests and 14 geological bores amounting to 28,000 ft. approximately.

The broad indications of these trials appeared to be unfavourable to the hopes of finding oil-supplies in the south-east of England, but despite this the *Gulf Exploration Company* (*Great Britain*). *Ltd.*, selected a site at Penshurst a few miles north-west of Tunbridge Wells and began drilling from an horizon in the Hastings Sand beds (Lower Cretaceous) at the end of May, 1938. Operations made rapid progress and the bit left the Cretaceous and traversed the Purbeck beds down 11,000 ft., the Kimmeridge Shales to 2,428 ft., Corallian limestone to 2,897 ft., the Oxfordian, Great Oolite, Lias, and entered the Carboniferous at about 4,500 ft. By the end of August the drill was down into the Lower Carboniferous Limestone at 5,600 ft. when a drill pipe twisted off. A few weeks later the hole was abandoned as it was considered the possibilities of finding oil had been exhausted. This represents the second deepest boring made in the present series, the first place being taken by the D'Arcy Company's Portsdown hole which went to 6,556 ft.

Geological tests of the Wealden series at Chaldon Down, north-west of Lulworth Cove in Dorset, were made with cable tool equipment in April 1938 by the *D'Arcy Company*. The information obtained negatived the idea of running a deep test, and work was concluded in the area in May, except for a second drilling test started by a contractor in September which has attained a depth of 962 ft.

Since that date no further drilling has been undertaken in the South of England.

New Licence Areas

The D'Arcy Company has taken up licences over an area of about 200 sq. mls. in the County of Lancaster around the town of Omskirk and reaching the coast near Formby; about 46 sq. mls. in a belt of country from the south-west of Derby

to Ashby-de-la-Zouch; and 143 sq. mls. in Yorkshire from Hayburn Wyke and Filey Brigg inland to Pickering. Exploratory drilling has begun in the first of these areas.

The Anglo-American Company has taken up a new concession in Fife and Kinross including the northern shore of the Forth from a point west of Charlestown eastwards to Dysart and inland to include the southern border district of Kinross.

Geophysical Survey Work

The D'Arcy Company has carried an extensive programme of geophysical prospecting in the country north and south of the Humber, particularly in Lincolnshire, with the object of elucidating the problem of the structural conditions in the Carboniferous underlying Permian and subsequent formations. Gravimeter, magnetic, torsion balance, and pendulum traverses have been carried out over an area of some 3,600 sq. miles, and in the course of the work a total depth of over 56,000 ft. has been drilled for seismic and other purposes. A torsion balance survey made in the period from January 1936 to April 1937 comprised 18 traverses and approximately 1,250 observation stations, and extended over the whole of the area. Strong gravity anomalies were recorded south of Lincoln City and near Scunthorpe, and these areas are now being examined in detail seismographically.

Similar work has been performed in the Midlands by the Anglo-American Oil Company, and magnetic surveys appear to indicate a continuation of the measures of the Notts coal-field to the east of Lincoln, confirming Kendall's theory as to the eastern margin of that area.

Reference has already been made to the gravimeter and magnetic work being done by the Gulf Exploration Company in the Cleveland Hills.

To date the total depth drilled in the whole of the United Kingdom exceeds 12 miles and represents 12 major tests completed, 4 in progress, and more than 30 geological bores. So far only the Midlothian No.1 and Hardstoft trials have proved successful, and from them (the latter since re-conditioning) about 200 tons of oil have been obtained. The cost of the search has probably exceeded £500,000, nevertheless efforts to find oil here cannot be said to have declined in intensity.

TABULAR SUMMARY OF OIL BORINGS

(Up to 15th March 1939)

Boring.	Location.	Drilling Period.	Geological Range.	Depth (ft.)	Notes.
D'Arcy Exploration Co., Ltd. *Major Drillings*					
Portsdown	N. of Portsmouth	30th Mar. 1936–15th Feb. 1937	Upper Chalk —Trias	6,556	Dry hole.
Henfield	Steyning, Sussex	25th June 1936–15th Mar. 1937	Weald Clay —Upper Carb.	5,105	Dry hole.
Kingsclere	Newbury, Hants.	29th May 1937–17th Jan. 1938	Upper Greensand —Trias	5,125	144 ft. bed of ironstone (Inferior Oolite) at 3,653 ft.
Eskdale No.1	W. of Whitby, Yorks.	17th July 1937–25th Nov. 1937	Upper Jurassic —Trias	2,486	Hole blocked. 3 sidetrack holes failed.
Eskdale No.2	W. of Whitby, Yorks.	15th June 1938–Still drilling	Upper Lias —Permian	4,260	130 ft. E. of No.1. Strong gas show in Permian at 4,212 ft.
Hardstoft	Derby	7th Sept. 1938–25th Sept. 1938	Middle Coal Measures —Lower Carb. Limestone	3,272	Re-trial of a 1919 well. Conditioning successful, increased oil yield.
Cousland No.1	Dalkeith, Midlothian	5th Sept. 1937–12th Sept. 1938	Lower Lst. Group (Carb.) —Oil Shale Group	2,917	Natural Gas Shows Depths ft. — Flowage cu. ft. 1188-1209 — 20,000 1248-1279 — 30,000 1582-1632 — 4,000,000 1720-1807 — 6,250,000 2694-2122 — 150,000

Boring.	Location.	Drilling Period.	Geological Range.	Depth (ft.)	Notes.
Cousland No.2	Dalkeith, Midlothian	8th Nov. 1938–Still drilling	Lower Lst. Group (Carb.) —Oil Shape Group	*1,878*	½ ml. W. of No.1.
Cousland No.3	Dalkeith, Midlothian	13th Mar. 1938–Still drilling	Lower Lst. Group (Carb.) —Oil Shale Group	*118*	2 ml. N. of No.1.
Gun Hill	Leek, Staffs.	20th Apr. 1938–26th Jan. 1939	Millstone Grit Series —Lower Carb.	4,629	Dry hole.
Eakring No.1	Ollerton, Notts.	Drilling not yet commenced	Triassic Marls —Carb. Lst.		Test on concealed Carboniferous meridional structure.
Geological Bores					
Pevensey No.1	Chilley	24th Feb. 1936–5th Mar. 1936	Weald Clay —Ashdown Sand	210	
Pevensey No.2	Stone Cross	3rd Feb. 1936–21st Feb. 1936	Weald Clay —Wadhurst Clay	307	
Pevensey No.4	Rickney	14th Jan. 1936–30th Jan. 1936	Weald Clay —Wadhurst Clay	218½	
Pevensey No.8	Rockhouse Bank	10th Mar. 1936–27th Mar. 1936	Weald Clay —Wadhurst Clay	222	
Lewes No.1	Little Dene, Lewes	1st Apr. 1936–3rd Apr. 1936	Lower Chalk —Gault	76	
Lewes No.2	Swanborough Farm, Lewes	6th Apr. 1936–9th Apr. 1936	Lower Chalk only	101	
Kingsclere	Sydmonton, Hants.	16th Apr. 1936–15th May 1936	Upper Greensand —Weald Clay	500	

Boring.	Location.	Drilling Period.	Geological Range.	Depth (*ft.*)	Notes.
Ham	Kingsclere, Wilts.	3rd June 1936–4th July 1936	Lower Chalk —Weald Clay	528	
Broad Bench	Kimmeridge Bay, Dorset	3rd Dec. 1936–24th Aug. 1937	Kimmeridge Clay (Upper Oolites) —Corallian	943	
Poxwell No.1	Weymouth, Dorset	3rd Feb. 1937–6th Feb. 1937	Upper Chalk only	40	
Poxwell No.2	Weymouth, Dorset	8th Feb. 1937–9th Feb. 1937	Upper Chalk only	62	
Poxwell No.3	Weymouth, Dorset	10th Feb. 1937–10th Mar. 1937	Purbeck —Gault	432	Drilled through fault in Upper Greensand at 230 ft.
Poxwell No.4	Weymouth, Dorset	24th May 1937–29th July 1937	Portland Sand (Upper Oolites) —Fuller's Earth	1,666	
Ringstead	Dorset	19th Mar. 1937–1st Apr. 1937	Sandsfoot Beds —Nothe Clay	161	
Hankham	Pevensey	18th Jan. 1938–4th Mar. 1938	Lower Tunbridge Wells Sands —Kimmeridge Clay	842	Tests on Wealden, Purbeck and Portland strata.
Chaldon Down No.1	Lulworth Cove, Dorset	6th Apr. 1938–3rd May 1938	Upper Chalk only	178	To test oil possibilities of concealed Wealden strata.
Chaldon Down G.1	Lulworth Cove, Dorset	23rd Sept. 1938–still drilling	Upper Chalk —Purbeck (as yet)	962	Contract work (Duke & Ockenden Ltd.).

Boring.	Location.	Drilling Period.	Geological Range.	Depth (ft.)	Notes.
Coalport G.1 .	Broseley, Shropshire	5th June 1938–15th June 1938	Permian —Silurian	243	Coal Measures unconformable on Silurian.
Coalport G.2 .	Broseley, Shropshire	18th June 1938–9th Aug. 1938	Permian —Silurian	963	Silurian at 935 ft.
Coalport G.3 .	Broseley, Shropshire	12th Aug. 1938–11th Sept. 1938	Permian– —Silurian	648	Silurian at 630 ft.
Cousland G.1 .	Dalkeith, Midlothian	25th Sept. 1938–14th Oct. 1938	Lower Carboniferous	325	Information for site of Cousland No.3 deep test.
Cousland G.2 .	Dalkeith, Midlothian	17th Oct. 1938–26th Oct. 1938	Lower Carboniferous	169	
Cousland G.3 .	Dalkeith, Midlothian	31st Oct. 1938–14th Nov. 1938	Lower Carboniferous	356	
Balfour G.1 .	Markinch, Fifeshire	25th Oct. 1938–22nd Nov. 1938	Millstone Grit Series	678	Information for location of deep test well. Drift 40 ft.
Balfour G.2 .	Markinch, Fifeshire	22nd Nov. 1938–19th Dec. 1938	Millstone Grit Series	924	Drift 34 ft.
Balfour G.3 .	Markinch, Fifeshire	25th Nov. 1938–6th Dec. 1938	Millstone Grit Series	670	Drift 43 ft.
Balfour G.4 .	Markinch, Fifeshire	21st Dec. 1938–14th Jan. 1939	Millstone Grit Series	520	Drift 40 ft.
Pentland G.1 .	Edinburgh	29th Dec. 1938–30th Jan. 1939	Lower Carboniferous	534	Test on Pentland Fault oil shows.
Pentland G.2 .	Edinburgh	27th Jan. 1939–30th Jan. 1939	Lower Carboniferous	70	
Pentland G.3 .	Edinburgh	31st Jan. 1939–13th Feb. 1939	Lower Carboniferous	260	
Formby G.1 .	Formby, Lancs.	6th Mar. 1939–Still drilling	Keuper Marl	455	Information for a deep test.

Boring.	Location.	Drilling Period.	Geological Range.	Depth (*ft.*)	Notes.
Anglo-American Oil Co., Ltd.					
Major Drillings					
Grove Hill .	Hellingly, Sussex	18th May 1937–17th Sept. 1937	Wadhurst Clay —Upper Carb.	3,506	Natural-gas sand of Heathfield nearby not encountered.
Midlothian No.1	Dalkeith, Midlothian	30th Oct. 1937–28th May 1938	Lower Lst. Group (Carb.) —Devonian	3,857	*Oil at* 1,733–1,760 *ft.* Yield to date 1042 bls. Several gas sands.
Midlothian No.2	Dalkeith, Midlothian	3rd Nov. 1938–12th Mar. 1939	Lower Lst. Group (Carb.)	2,942	Testing.
Midlothian No.3	Dalkeith, Midlothian	Drilling not yet commenced	Lower Lst. Group (Carb.)	—	
Gulf Exploration Co. (Great Britain) Ltd.					
Major Drilling					
Penshurst .	Tunbridge Wells	26th May 1938–27th Aug. 1938	Ashdown Sand —Lower Carb. Limestone	5,600	Dry hole
Geological Bores					
Rainham C.H.1 .	Kent	Sept. 1937	Chalk only	130	Chalk cavitous, circulation lost.
Bredhurst C.H.2	Kent	Sept.-Oct. 1937	Chalk only	130 135 170 410	Four holes drilled at this site. Loss of mud circulation in Chalk cavities caused abandonment of drilling.
Steel Bros. & Co., Ltd.					
Upper Booth .	Edale, Derbyshire	27th Sept. 1937–9th Apr. 1938	Carb. Limestone Series (Edale & Bowland Shales)	757	Abandoned in Oct. 1938. Water trouble.

REPORTS OF RECENT INVESTIGATIONS AT THE IMPERIAL INSTITUTE

Selected from Reports made to the Dominion, Indian and Colonial Governments

CALCINATION TESTS ON GOLD COAST BAUXITES

THE Gold Coast contains large deposits of bauxite of good quality which could be economically mined, but up to the present high costs of transport have prevented their utilisation. The Gold Coast Geological Survey has therefore been investigating the possibility of up-grading the bauxite to reduce freight charges. The bauxite has an average alumina content of about 54 per cent., is low in silica, rather high in iron, and has a fairly high water content, averaging 28 per cent. It is clear that a considerable up-grading of the ore could be achieved if the water could be eliminated.

As a first step, calcination tests were carried out in the Imperial Institute laboratories and the results, which were duly reported to the Gold Coast authorities, have now appeared in the *Report on the Geological Survey Department for* 1937-38. The material chosen for investigation consisted of bulk samples from the two largest bauxite deposits, namely, from Yenahin in Ashanti, and Mt. Supirri, Sefwi Bekwai, in the Colony. The results of the calcination tests are shown in the accompanying tables.

A fact of note among these results is that the Gold Coast bauxites examined, when ground to –10 mesh and heated to constant weight at 250° C., lose water to the extent of 22·3 and 16·6 per cent., but to achieve constant weight 18 hours heating are required. A result of more practical significance, shown in Table II, is that on one hour's heating at 300° C. the same materials ground to the same mesh lose 19·4 and 15·6 per cent. respectively. It is safe to assume that finer grinding would increase the amount of water eliminated in a given time. The tests thus suggest that by calcination of the ground bauxite the bulk of the water could be removed quickly at a temperature of a few hundred degrees Centigrade, and an appreciable up-grading of the ore thereby effected. With the large supplies

TABLE I. GOLD COAST BAUXITE—DATA FOR TEMPERATURE-LOSS CURVE

Temperature.	Duration of heating to approximately constant weight.	Percentage decrease in weight on heating.		Temperature.	Duration of heating to approximately constant weight.	Percentage decrease in weight on heating.	
		L.O.6* –10 mesh.	L.O.7† –10 mesh.			L.O.6 –1 in. mesh.	L.O.7 –1 in. mesh.
°C.	*Hours.*	*Per cent.*	*Per cent.*	°C.	*Hours.*	*Per cent.*	*Per cent.*
45	1	0·3	0·3	—	—	—	—
70	17	0·4	0·6	—	—	—	—
105	20	0·6	0·8	120	20	0·5	0·7
135	1	0·7	0·8	—	—	—	—
145	1	0·8	0·9	—	—	—	—
185	17	2·2	2·0	200	3	1·0	1·7
225	58	21·2	15·8	225	40	15·3	11·0
250	18	22·3	16·6	—	—	—	—
260	18	22·4	16·8	—	—	—	—
300	18	24·0	17·7	300	28	23·8	17·3
450	15	26·4	22·6	450	9	27·3	23·0
700	2	26·9	23·6	700	2	27·6	23·8
900	2	27·3	24·2	—	—	—	—
1,000–1,150	1	27·5	24·4	1,000	2	27·8	24·3

L.O.6.—Bulk sample of bauxite from Yenahin deposits, Ashanti. † *L.O.7.—Bulk sample of bauxite from Mt. Supirri, Sefwi Bekwai deposits.*

TABLE II. GOLD COAST BAUXITE—DATA FOR TIME-LOSS CURVE (300° C.)

Duration of heating.	Percentage decrease in weight.			
	L.O.6 -10 mesh.	L.O.6 -1 in. mesh.	L.O.7 -10 mesh.	L.O.7 -1 in. mesh.
Hours.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
1	19·4	5·0	15·6	4·8
2	21·9	8·0	16·3	7·5
3	22·3	—	16·5	—
4	22·5	—	16·7	—
5	—	15·8	—	14·3
7	22·9	—	16·9	—
9	—	22·7	—	16·5
25	24·0	—	17·6	—
28	—	23·8	—	17·3

of wood available in the Gold Coast, producer-gas would probably provide an economical fuel for moderate temperatures. Further tests are now being carried out at the Imperial Institute to determine the percentage of the alumina which can be leached by caustic soda from the calcined bauxites, as this is the final factor which determines the value of the ore.

PROGRESS IN COLONIAL MINERAL INDUSTRY

UNDER this heading it is intended to publish quarterly statements regarding mining and geological activities in the Colonial Empire. If possible, statistics will be given of production, tonnage and grade of ore treated at the more important mines. Information will also be given where available regarding important prospecting concessions, new markets, etc. This data will be supplemented by the valuable six-monthly reports on the work carried out by the Colonial Geological Surveys, which have hitherto appeared in this BULLETIN under the heading of " Recent Research on Empire Products."

In order that the information published may be both authentic and up to date, the Institute has invited the assistance of the Chief Inspectors of Mines in the countries concerned, as it is only by the cordial co-operation of these officers that the desired result can be attained.

As the Institute's appeal for these quarterly statements was only made late in 1938, it has not been possible to receive the data from many countries in time for publication in the present issue.

Already it has become evident that all the statements regarding production cannot refer to the same three months, but this should in no way detract from their usefulness.

BECHUANALAND

The .following information has been received from the Government Secretary.

Gold and Silver.—The producing mines are situate in the Tati District, and the following is a statement of their output for the eleven months ended November 30, 1938:

	Troy oz.	£.
Gold . . .	16,823·6	93,001
Silver . .	1,053·2	114

The gold premium amounted to £24,477.

The above production was from ten mines in the Tati District, but the bulk of the output was accounted for by three mines only.

Diamonds.—No diamonds have yet been won in the Bechuanaland Protectorate.

On April 17, 1937, a Crown Grant was issued to a Company conferring the sole and exclusive right to prospect for and win diamonds on certain Crown Lands situate within the boundaries of the mining districts of Ghanzi, Chobe and Kgalagadi and in a portion of the District of Lobatsi.

Concessions.—There is only one concession in force at present in the Bechuanaland Protectorate and that is in favour of a Company in respect of an area of approximately 100 sq. miles in the Bakgatla Reserve. So far as can be ascertained no mining operations have been undertaken under this concession.

CYPRUS

The following statement has been received from the Acting Inspector of Mines regarding mining activities in Cyprus during the last six months of 1938.

The production of cupreous pyrites showed a decrease for the last six months of 1938, compared to the corresponding period of last year, although the exports showed a slight increase.

There was very little activity in prospecting during the period.

Exports of asbestos fibre and terra umbra showed a marked decrease compared to the preceding year.

MINERAL PRODUCTION AND EXPORT

	Last 6 months 1938.	Last 6 months 1937.
Cupreous pyrites (dry weight)	*Tons.*	*Tons.*
Skouriotissa Mine, production .	84,613	101,095
,, ,, exports . .	71,889	106,261
Mavrovouni Mine, production .	182,079	311,643
,, ,, exports . .	108,510	91,982
Lymni Mine, production .	6,319	7,556
,, ,, exports . .	nil	1,602
Kalavaso Mine, production .	36,176	32,893
,, ,, exports . .	28,068	28,971
Cupreous concentrates (dry weight)		
Mavrovouni Mine, exports . .	89,813	61,688
Chrome iron ore		
Production	3,560	746
Exports	7,413	480
Gold (contained in ores, concentrates, and precipitates)	*Troy oz. fine.* 9,183	*Troy oz. fine.* 14,676
Silver (contained in ores, concentrates, and precipitates)	48,526	75,787
Asbestos (Tunnel Asbestos Cement Co., Ltd.)	*Tons.*	*Tons.*
Rock mined	738,454	901,982
Rock treated	173,766	222,345
Asbestos fibre produced . .	4,995	7,027
,, ,, exported . .	3,450	7,632
Other minerals exported		
Gypsum, calcined . . .	1,530	2,298
,, raw	2,214	3,912
Stone, pumice	21	nil
Terra umbra	1,796	3,016
Terra verte	5	2

GOLD COAST

The Director of the Geological Survey has forwarded the following statement of work carried out by his Department during the six months ended December 31, 1938.

The detailed geological mapping of the Tarkwa Goldfield and the Nsuta manganese deposits and surrounding country, mostly on a scale of 1 : 25,000 but partly on a scale of 1 : 10,000

and larger scales, was practically completed, and the underground workings of several of the gold mines of the area were also examined in detail. In addition, parts of the Sefwi and Wassaw districts were geologically mapped and prospected.

As a result of the detailed mapping of the Tarkwa Goldfield and Nsuta manganese-ore deposits, the detailed geological structures of these deposits are now clear, and it is possible to predict fairly closely the depth of the banket horizon at most places in the Tarkwa Goldfield.

Water Supply.—The construction of village water supplies, dams, ponds, and wells in Dagomba was continued as vigorously as possible with the small staff available. Great difficulty was experienced in filling new appointments.

At the end of the year two dams, thirteen ponds, ten bilisi (storage wells), six wells and three tube wells had been completed. In addition six dams, three bilisi and three wells were under construction.

Publications.—The geological map of the Birim Diamondfield was published and also a revised geological map of the Gold Coast on a scale of 1 : 1,000,000.

The Acting Chief Inspector of Mines reports the following productions for the quarter ending December 31, 1938:—Gold won, 181,488 fine oz.; Diamonds exported, 267,065 carats.

KENYA

The following information regarding progress in the mining industry of Kenya during the three months' period, September to November 1938, has been supplied by the Commissioner of Mines.

New Mines and Concessions.—The Borderland Syndicate, Ltd., have pegged claims on a discovery of gold near the Kenya-Uganda border.

The Watende Mines' property in South Kavirondo has been taken over by the Ngiga Mining Co., Ltd., and steps are being taken to bring the property into production.

Kenya Consolidated Goldfields, Ltd., have commenced milling in the Lolgorien district of the Masai Province.

The mineral output of Kenya during the period under review is shown in Tables 1, 2 and 3.

TABLE I.—LODE PRODUCTION OF GOLD
(September–November 1938)

	Material Treated.		Yield.		Value.*
	Ore.	Sand.	Ore.	Sand.	
North Kavirondo (Kakamega)	*Tons.*	*Tons.*	*Oz. Dwt.*	*Oz. Dwt.*	£ s.
Rosterman Gold Mines, Ltd.	8,721	—	4,207 18	—	23,564 5
Kimingini Gold Mining Co., Ltd.	5,950	—	2,437 13	—	14,599 18
Kavirondo Gold Mines, Ltd.	3,584	85¾	1,287 13	61 01	7,552 15
Bukura Mining Co., Ltd.	1,779½	165	924 15	52 16	5,474 5
Edzawa Ridge Mining Co., Ltd.	867	99	936 01	7 02	5,312 0
Edzawa Ridge Mining Co., Ltd.	—	*198* (slimes)	—	5 09	
Sama Syndicate	861½	—	327 19	—	1,836 10
S. Everett	1,243	—	313 09	—	1,755 5
C.N.G. Koch—K. Concessions	670	—	212 15	—	1,191 15
Forest Edge Mines, Ltd.	570	—	133 16	—	749 10
Blue Reefs, Ltd.	191	—	95 00	—	531 10
T. C. Elliott (Oct. and Nov.)	601	—	84 19	—	475 15
Kenya Reefs, Ltd. (Oct. and Nov.)	295	—	49 17	—	279 5
Eldoret Mining Syndicate (Sept. only)	305	—	29 12	—	165 15
H. N. Beresford (Oct. and Nov.)	95	—	22 03	—	124 0
D. Broadhead-Williams (Nov. only)	73	—	20 03	—	112 15
Button and Mason Mines, Ltd. (Sept. only)	(clean up)	—	10 16	—	60 10
Miscellaneous Productions†	149	—	30 02	—	168 10
Area No. 2					
Pakaneusi Prospecting & Development Co., Ltd.	2,951	5,123	886 12	746 05	9,143 15

* *The values are calculated by assuming the bullion to be 800 fine and the price of gold to be 140s. per fine oz.*

† *Represents total of outputs less than £50 in value per month.*

	Material Treated.		Yield.				Value.*	
	Ore.	Sand.	Ore.		Sand.			
	Tons.	*Tons.*	*Oz.*	*Dwt.*	*Oz.*	*Dwt.*	£	*s.*
Ngiga Mining Co., Ltd.	2,463	—	1,070	07	—		5,994	0
Kavirondo Gold Mines, Ltd.	1,900¼	—	729	07	—		4,084	10
Bellamira Development and Mining Co., Ltd.	2,784	2,350	556	02	142	04	3,910	10
Asembo Mines, Ltd.	2,034	—	566	00	—		3,169	15
R. E. G. Russell	350	1,000	94	00	269	05	2,034	5
A. Konstant	316	506	109	01	230	05	1,900	0
Lantana, Ltd.	1,093	765	147	04	113	08	1,520	5
Lantana, Ltd.	—	84 (slimes)	—		10	19		
Coronation Mines, Ltd.	396	514	61	13	102	00	1,177	0
Coronation Mines, Ltd.	—	334 (slimes)	—		46	11		
Uniter Gold Syndicate	269	—	187	11	—		1,050	0
Robert Boiteux	116 (and clean up)	70	167	04	17	00	1,031	10
Button and Ralph	438	500	130	12	28	00	888	0
Button and Ralph Syndicate (Oct. and Nov.)	10½	1,120	14	10	124	18	780	15
Gem Gold Syndicate (Oct. and Nov.)	330	—	114	03	—		639	5
J. Maxwell & Co.	469¾	—	112	00	—		627	5
Mrs. K. M. Forrester (Sept. only)	240	—	91	12	—		513	0
P. P. Whitmarsh	—	609	—		88	15	497	0
Sunshine Syndicate	1,001	—	86	00	—		481	10
Major S. Robertson	183½	—	68	14	—		384	10
Midas Gold Mines, Ltd. (Sept. and Nov.)	55	—	30	02	—		167	0
Serananje, Ltd. (Sept. only)	136	—	27	11	—		154	5

* *The values are calculated by assuming the bullion to be 800 fine and the price of gold to be 140s. per fine oz.*

—	Material Treated.		Yield.				Value.*	
	Ore.	Sand.	Ore.		Sand.			
	Tons.	*Tons.*	*Oz.*	*Dwt.*	*Oz.*	*Dwt.*	£	*s.*
Abiru Syndicate (Oct. only)	—	264	—		16	12	93	0
Miscellaneous Productions†	135	—	16	01	—		90	0
South Kavirondo (Gori River)								
Kenya Gold Mining Syndicate Ltd.	4,379	2,700	1,964	00	299	00	12,673	0
Macalder Mines, Ltd.	5,026 (and clean up)	—	738	15	—		4,137	0
M. Radford	574	306	177	00	253	19	2,413	5
Rhino Syndicate	299	90	176	13	12	00	1,056	10
Monogo Syndicate	536	—	109	02	—		611	0
Watende, Ltd. (Oct. only)	—	510	—		47	10	266	0
Masai Province, Lolgorien								
R. W. B. Matthewson	339	220	123	07	41	05	921	15
Ndorobo Mines, Ltd.	328	328	99	06	91	00	1,065	10
A. Owen (Sept. and Oct. only)	66	—	41	00	—		229	10
A. Rainbow	77	77	16	13	8	09	140	10
Kanji Naranji (Sept. only)	45	156	2	15	6	05	50	10
D. Cowen (Nov. only)	40	—	13	16	—		77	5
Miscellaneous Productions†	77	265	25	12	5	12	174	15

* *The values are calculated by assuming the bullion to be 800 fine and the price of gold to be 140s. per fine oz.*

† *Represents total of outputs less than £50 in value per month.*

TABLE II.—ALLUVIAL PRODUCTION OF GOLD
(September–November 1938)

	Material Treated.	Yield.		Value.*	
	Cu. Yds.	*Oz.*	*Dwt.*	£	s.
North Kavirondo (*Kakamega*)					
Kenya Reefs, Ltd.	14,519	372	17	2,088	0
H.S.F. Syndicate	7,724	112	04	628	10
O. Fayle	3,420	70	15	396	5
Mayers and Allen (Sept. and Oct.)	550	28	00	156	15
G. Taylor (Sept. and Nov.)	1,500	21	05	119	0
Mrs. A. M. du Preez	1,410	30	05	169	10
Kavirondo Gold Mines, Ltd. (Oct. only)	433	14	17	83	5
Miscellaneous Productions†	1,181	22	01	123	5
No. 2 Area					
Miscellaneous Productions†	121	7	03	40	0

* *The values are calculated by assuming the bullion to be 800 fine and the price of gold to be 140s. per fine oz.*

† *Represents total of outputs less than £50 in value per month.*

TABLE III.—TOTAL PRODUCTION AND VALUE OF GOLD
(September–November 1938)

	Oz.	Dwt.	£	s.
Lode gold . .	22,646	06	128,101	13
Alluvial gold .	679	07	3,804	10
Total .	23,325	13	131,906	3

MALAY STATES, FEDERATED

The following statement regarding mining activities in the Federated Malay States during the period October to December 1938 has been compiled from data furnished by the Chief Inspector of Mines.

PRODUCTION OF TIN ORE
(October-December 1938)

State.	Metal content (*Long tons*).	Value. (£)
Perak	3,858	883,486
,, (buffer stock) . .	1,148	241,881
Selangor	2,035	461,521
,, (buffer stock) .	575	121,466
Negri Sembilan . . .	292	67,973
,, ,, (buffer stock)	88	18,404
Pahang	269	60,518
,, (buffer stock) . .	83	15,889

The valuation of the tin production is based on the Customs' tin price at the time of export of the material, after making allowance for delivery and refined tin charges.

PRODUCTION OF OTHER MINERALS
(October-December 1938)

		Pahang.	Perak.	Selangor.	Negri Sembilan.	Total.
Gold	*oz.*	9,920	1,248	96	266	11,530
Wolfram .	*tons**	—	—	—	—	3
Scheelite	,, *	—	20	—	—	20
Coal .	,, †	—	—	99,232	—	99,232
China-clay	,,	—	50	48	—	98
Amang .	,, *	—	—	—	—	1,627
Haematite	,,	—	244	—	—	244

* *Export.*
† *Excluding coal produced and consumed at the colliery.*

LABOUR FORCE EMPLOYED IN F.M.S. MINES
(Average for October-December 1938)

Mines.	Pahang.	Perak.	Selangor.	Negri Sembilan.	Total Average.
Tin . . .	4,009	28,950	15,059	1,286	49,304
Gold. . .	2,073	400	—	331	2,804
Scheelite . .	—	307	—	—	307
Wolfram . .	19	16	—	13	48
Coal . . .	—	—	3,877	—	3,877

Tin.—The tin ore won from mines, which are European owned, managed or financed by European capital, amounted in 1938 to 67 per cent. of the total output of the Federated Malay States, as compared with 33 per cent. from mines owned and managed exclusively by Chinese. The corresponding percentages in 1927 were 41 and 59.

The majority of the Malayan tin is won from alluvial workings, the Pahang Consolidated Co. operating the only lode tin mine of importance in Malaya. This mine yielded about 3·25 per cent. of the total production of the Federated Malay States in 1938.

Coal.—Coal is produced at only one property, viz., that of the Malayan Collieries, Ltd., in Selangor. There are two seams separated by 100 ft. or so of strata, the net thickness of the top seam being 40 ft. while that of the lower varies from 25-40 ft. Electrical energy used for working the property is supplied from a central station having a capacity of 5,300 kilowatts.

Amang.—Amang is the name given in Malaya to the heavy minerals found in alluvial deposits. On those Malayan tin mines where magnetic separation has been used to dress the tin ore, the magnetic residue consists mainly of ilmenite in a condition ready for export.

MALAY STATES, UNFEDERATED, AND MALACCA

The following table showing the quantities of various minerals exported from the Unfederated Malay States and Malacca has been taken from a monthly statement prepared by the Chief Inspector of Mines.

EXPORTS OF MINERALS
(October–December 1938)

State.	Tin in ore at 75.5 per cent.	Gold.	Manganese ore.	Wolfram.	Bauxite.	Iron ore.
	Long tons.	*Oz.*	*Long tons.*	*Long tons.*	*Long tons.*	*Long tons.*
Johore .	122	—	—	—	21,386	162,029
Kedah .	36	—	—	41	—	—
Perlis .	156	—	—	—	—	—
Kelantan	3	189	871	—	—	37,780
Trengganu	59	—	7,350	33	—	238,060
Malacca .	42	—	—	—	—	—
Total .	418	189	8,221	74	21,386	437,869

The Commissioner of Lands and Mines, Trengganu, reports that the production of iron ore in this State is confined essentially to two Japanese companies. He further states that no important prospecting or mining enterprise was commenced during the last quarter of 1938.

NYASALAND

The following statements relating to the mining activities in the Protectorate during October-December 1938, and of the work of the Geological Survey for the period July-December of the same year, have been supplied by the Acting Director of the Survey.

Mining Activities during October-December 1938

Kyanite.—The kyanite deposit near Kapiridimba, Ncheu District, has attracted the attention of a South African mining company, who hold prospecting licences in the Protectorate covering about 220 acres. A further larger area, in the Chingoma and Nundu districts, some 15 miles to the south of Kapiridimba, is also being prospected by the same company.

The Kapiridimba kyanite has been proved to be of commercial quality and it is understood that a ready market can be found for it. In the other area there are no large workable outcrops, and the kyanite so far discovered is of poorer quality ; it is hoped, however, that further prospecting will reveal deposits of better quality.

The main part of the Kapiridimba deposit forms two small hills rising 125 ft. and 50 ft. respectively above the general level of the country. Boulders of kyanite-quartz-gneiss and massive kyanite rock occur along the crests and upon the upper slopes of these hills. Some of the boulders are estimated to contain up to 30 tons of massive kyanite. The geologist of the mining company concerned estimates that production will eventually reach from 15,000 to 20,000 tons annually.

Bauxite.—The bauxite deposits of Mlanje Mountain are now being systematically prospected by the Anglo-American Corporation of South Africa, Ltd., who hold an exclusive prospecting licence over the known deposits.

The deposits were described in the Imperial Institute Bulletin, No. 4 of 1926 (Vol. XXIV). They occur on the

Luchenya Plateau, which consists of rolling grassy uplands at an elevation of about 6,000 ft. The principal occurrence, which is of commercial quality, extends over an area of at least 2 sq. miles, and, in general, ranges from 15 to 30 ft. in depth.

British South Africa Company's Mineral Survey.—The British South Africa Company report that the mineral survey of their areas, comprising about 15,000 sq. miles of country in the Northern Province, has so far not led to the discovery of economic mineral deposits of any value.

Work of the Geological Survey, July-December 1938

During the latter half of 1938 much of the time of the Director and of the Geologist was occupied in the examination of specimens collected earlier in the year and in the preparation of the relative reports and maps.

The area dealt with lay mainly in the highlands to the west of Lake Nyasa in the Mzimba, West Nyasa and Kasungu Districts. The geologist's activities were confined chiefly to topographical and geological reconnaissance work to serve as a basis for a more detailed survey.

Three erosion levels are distinguishable : the Nyika Plateau of approximately 7,000 to 8,000 ft. altitude ; the Vipya Range, approximately 5,000 to 6,000 ft. ; and the Rukuru-Kasitu Plain, about 3,000 to 4,000 ft.

In general, the area is built up of gneisses of the Basement Complex forming the plains, with protruding bosses of various heights of acid intrusive rocks. The gneisses comprise micaceous, felspathic, quartzitic, garnetiferous, and, occasionally, hornblendic types, talcose schists also having been observed. Lit-par-lit and augen gneisses are common. The rocks in the south of the area are noticeably more highly metamorphosed than those in the north, and a definite gradation can be traced. Sills and dykes of intermediate and basic composition occur, more especially in the Kasitu Valley. A thin sandy alluvium covers part of the floor of the Rukuru Valley. Karroo sediments, pale grey shales, mudstones, marls and fine-grained felspathic sandstones are found at about 11 miles north of Mt. Njakwa.

Pebble deposits are widespread over the lake shore plains and on the slopes of the adjacent hills. Their significance is

being studied and they are expected to provide interesting data relating to the late geological history of the region.

Muscovite mica of small size was noted in several localities and small deposits of kaolin are to be found. The presence in the kaolin of siliceous grit detracts from its possible commercial value. Only occasional colours of gold were found in a few streams.

A short traverse was made in the Mwanza Valley (Lower River area) to link up previous explorations, and two weeks were spent in the further examination of the Kapiridimba, Ncheu, kyanite deposit.

The Director visited Northern Rhodesia in connection with the development of water-supplies in that country.

Water supply operations were continued in the Dowa, Lilongwe, Upper Shire and South Nyasa Districts, some 57 dug wells and 5 bore holes being completed. One driller proceeded on home leave in August.

Both the Director and the geologist proceeded on home leave towards the end of the year.

A paper has been prepared for publication upon the physiographical development of central and southern Africa.

SARAWAK

The following details relating to the mining industry of Sarawak for the three months' period September-November 1938 have been supplied by the Chief Secretary, Sarawak.

GOLD

District.	Month.	No. of Leases extant.	Reported production (*Fine oz.*)
Kuching . .	September	1	11·8
	October	1	23·7
	November	1	10·1
Bau . .	September	26	1546·3
	October	29	1593·3
	November	29	1393·6
		Total	4578·8

The principal gold mines include the following: Tai Ton Gold Mining Syndicate; Bukit Young Gold Mining Co., Ltd.; Borneo Gold Mining Co., Ltd.; Sarawak Mining Syndicate, Ltd.; Krokong Gold Mining Syndicate; Kim Seng Gold Mining Co., Ltd.; and the Bau Gold Mining Syndicate.

The area covered by the 29 mining leases on November 30, 1938, was 4,254 acres. Of these, 28 grant the right to mine gold; the twenty-ninth, issued on June 29, 1938, over an area of 242 acres, gives the right to mine cinnabar and quicksilver.

Eight exclusive prospecting licences to prospect for gold, each issued for a period of one year and covering in all 1,785 acres, were extant on November 30, 1938.

TANGANYIKA

The following statement concerning the mining industry of Tanganyika has been supplied by the Acting Chief Inspector of Mines. The figures now available for the minerals which were exported or sold locally during 1938 are shown in the subjoined table. The provisional valuation of £703,405 constitutes a new high record for the sixth year in succession, and it is anticipated that 1939 will see the million pounds mark reached.

MINERALS EXPORTED OR SOLD LOCALLY DURING 1938

Mineral.	*Quantity.*	*Value (Provisional).*
Gold (Bullion unrefined)	112,267 oz. troy	£589,135
Diamonds . . .	3,590 carats	3,608
Mica (Sheet) . .	21·8 long tons	6,395
Mica (Waste) . .	14 ,,	224
Tin ore . . .	368 ,,	50,447
Tungsten ore . .	70 cwt.	689
Salt	9,515* long tons	52,543
Red ochre . . .	51* ,,	234
Talc	37* ,,	130
	Total	£703,405

* *Estimated.*

Phosphates (bat guano, etc., for agricultural purposes) and building materials (stone, sand, lime, etc.) were also obtained during the year, but statistics are not yet available. The value of these in 1937 was £3,144.

Gold.—Gold is the most important mineral produced in the Territory. The following table shows the five largest producers listed in order of their production. The figures given are the totals for the eleven months January to November 1938. The December figures are not yet available.

	Ore Crushed. (*Long tons.*)	Ore Cyanided. (*Long tons.*)	Production of unrefined bullion. (*Troy oz.*)
Mara Mine (South & Central African Gold Mines, Ltd.)	26,753	26,808	19,566
Buhemba Mine (Buhemba Mines, Ltd.) . .	11,500	10,344	10,405
Sekenke Mine (Tanganyika Central Gold Mines, Ltd.)	22,666	23,312	8,565
Ntumbi Mine (Ntumbi Reefs, Ltd.)	4,974	6,520	3,860
Ikungu Mine (Ikungu Mines, Ltd.) . . .	7,286	3,825	2,736

In addition to the above there were 10 mines each with a production of between 1,000 and 2,000 oz., eight with a production of between 500 and 1,000 oz., and 17 with a production of between 100 and 500 oz. of bullion for the 11 months. There were also a number of smaller producers. The export of unrefined gold bullion during 1938 (12 months) was 20·57 per cent. greater than during 1937, although a conspicuous falling off in alluvial gold production was again recorded.

The manner in which lode gold mining is forging ahead in spite of financial difficulties is most satisfactory. The Geita Mine of the Geita Gold Mining Co. completed the first 250 tons per day unit of its reduction plant in December. The erection of a 100 tons per day reduction plant at the Saza Mine, owned by New Saza Mines, Ltd., was well advanced at the end of the year, and this mine should commence production about March 1939. Other gold mines altered or extended their plant during 1938, and a number of small new mills started up or were under construction. An interesting event during the year was the taking over of two gold mines by the Soriano group, which has large and important mining interests in the Far East.

The output of alluvial gold continues to decline. The small-scale worker is finding it increasingly difficult to make his methods pay, and partly as a result of this and partly on account of opportunities for employment elsewhere, the number of diggers is dwindling.

Prospecting and development in the Ukonongo goldfield in the Western Province, the Territory's newest mineral field, indicate that this area may develop into an important copper-gold-silver-lead proposition. A trial consignment of 43 tons of lead-ore exported at the end of 1937 contained 74·5 per cent. metallic lead, 1,101·32 troy oz. of silver, and 3·355 troy oz. of gold.

Diamonds.—Production has been on a restricted scale in the Kwimba and Mwanza Districts. The finding early in 1938 of a stone weighing 35·5 carats, which was valued at £568, resulted in a slight renewal of interest in a known diamondiferous part of the Mwanza District.

Tin.—Production has again increased, the exports of tin-ore during 1938 being 35·3 per cent. greater than in 1937.

Tungsten.—The total exports of tungsten ore during 1938 amounted to 3½ tons.

Mica.—The exports of both sheet and waste mica have declined, though interest has been renewed in the mica occurrences of the Mbeya and Rungwe Districts.

Vermiculite.—So far it has proved impossible to market Tanganyika vermiculite at a competitive price, and development of the known occurrences in the Territory has therefore suffered.

Talc.—An occurrence of talc was discovered in the Pare District during 1938 and is being opened up. Trial consignments have already been sold locally.

Coal.—There have been no developments in connection with the extensive coal deposits which are known to exist in various parts of the Territory. The Government has recently stated that it is willing to consider applications from reputable companies for permission to prospect for coal in an area of approximately 5,000 sq. miles which has as its centre, Mkata, a station on the Central Railway, 151 miles west of Dar es Salaam, and which is at present closed to such prospecting.

Loans to Small Workers.—Arrangements are now in force whereby the Government, in approved cases, will advance loans of up to £5,000 to small workers to enable them to develop and equip their mines.

Mining Scholarships.—Another form of Government assistance to the mining industry was the provision for Tanganyika boys for three mining scholarships during 1938, and a further three for 1939. These are each worth £100 a year for two years and are tenable at the Bulawayo School of Mines. Those who complete the two-years' course satisfactorily will be apprenticed for a further period at Tanganyika mines before receiving their certificates. The demand for junior assistants on mines is already greater than can be met locally.

UGANDA

The following information has been received from the Acting Director of the Geological Survey regarding recent mining activities in that Colony.

Gold.—The output of this metal maintains a fairly even level, and most of the amount is exported from Buhwezu. No important new finds of alluvial gold were made in the west, but some progress was made in regard to lode working. The previously discovered vein at Kanyambogo in the Igara Schist area in N. Buhwezu has been taken over by another company and exploration work begun. Rubble is being crushed for gold at Katenga in that part of Buhwezu underlain by Karagwe-Ankolean sediments. No veins of economic importance other than small stringers have been found in these beds.

In the Eastern Province considerable progress has been made in the exploration of the veins at Busia, and crosscuts and drives at the 175 ft. level have served to prove the existence of several widths of payable lode. Track is now being laid underground to recover this ore. Hitherto about 300 oz. of gold a month have been won from the opencast workings where lode and selected laterite are put through the mills.

Several other lodes have been discovered in other parts of the Borderland area and on neighbouring properties, and an area to the north discovered by officers of the Geological Survey is about to be opened to tender.

The recent output of gold has been :

1938.		1937.	
Quantity. (*Troy oz.*)	Value. (£)	Quantity. (*Troy oz.*)	Value. (£)
20,645	146,070	16,947	119,292

Tin.—No new discoveries of tin have been made recently and the output maintains approximately the level of past months. A few grains have been noted in the concentrates from the Buhwezu area but are only of academic interest.

1938.		1937.	
Quantity. (*Long tons*)	Value. (£)	Quantity. (*Long tons*)	Value. (£)
404·276	78,579	360·812	87,635

Tantalite.—The export of tantalite has waned owing to the low grade of some of the ores and the working out of others.

It is to be hoped that some deposits may be found in Buhwezu, where concentrates of high-grade tantalite are found in the streams.

Wolfram.—A little wolfram has been exported from the Kigezi area where promising veins occur; exploration of these lodes is in hand.

Scheelite has been found in South Buhwezu, the first recorded occurrence in Uganda.

1938.		1937.	
Units.	Value.	Units.	Value.
66·79	£157	86·93	£345

Bismuth.—0·416 tons of bismuth carbonate were exported from Kigezi. This is the first time that this product has been won in quantity; it occurs in association with tinstone and some wolfram.

Asbestos.—52·25 tons of asbestos were produced for the purpose of insulation at a local sugar factory. The product, however, is too poor to warrant export.

Diamonds.—A diamond was discovered in the gold-bearing gravels of N.W. Buhwezu in December and another stone was sent in from a neighbouring area by Mr. Roberts, Geologist in this Survey. The stones are undoubtedly secondarily derived from the coarse portions of the Kagera-Ankolean sediments, and as such offer little or no hope of being found in quantity. It yet remains to be seen whether pipes and greater concentrations of the stones occur in the earlier schists surrounding the Karagwe-Ankolean plateau country.

Oil.—Prospecting for oil is still being carried on in the Lake Albert area near Butiaba, and a deep hole drilled on the top of a dome in this vicinity had reached about 3,500 ft. at the end of January. The sediments met with are mainly of an argillaceous type but some arenaceous bands occur near the lower parts of the borehole. The beds are without doubt the equivalents of the Kaiso and Kisegi Series of the type areas and there is no reason for believing that anything of Miocene or greater age has yet been seen. Some plant remains occur at about 2,560 ft., but they are not diagnostic.

It is hoped shortly to put down a series of holes, with the prospecting drill, at Kibero to the south.

ABSTRACTS AND NOTES

Mineral Industry of Ontario for 1937.—Ontario's mineral production in 1937 broke all previous records with a total value of $229,938,033 as against the previous record of $184,670,390 in 1936. A summary of mineral statistics and detailed data for the more important minerals are given in the "Preliminary Report on the Mineral Production of Ontario in 1937," by A. C. Young (*Bull. Ont. Dep. Min.*, No. 17, 1938). The main features of the year have been the expanding gold production, and an improvement in the nickel-copper industry following an increased demand for nickel which now finds wider applications outside the war industries. As an index of mining development, diamond-drilling was active, showing an increase over the previous year.

Gold production totalled 2,587,457 fine oz., as against 2,378,494 fine oz. in 1936. The tonnage of gold ore milled increased by 7·4 per cent., with an average value of $10.46 per short ton. The grade of ore mined shows considerable variation in the different areas, but the average values for the two largest producers are $9.13 per ton for Porcupine, and $14.73 per ton for Kirkland Lake. Gold milling increased during the year, both by enlargement of existing mills and the opening of five new mills.

The Sudbury nickel-copper industry treated 36 per cent. more ore than in the previous year, the total amounting to 6,304,517 short tons. The output of metallic nickel rose from 51,930 to 73,632 tons, or over 40 per cent., and blister copper increased by 12 per cent. to 154,415 tons. The recovery of precious metals in the refineries is now important, this source placing Sudbury first among the platinum-producing centres of the world with a total of 259,209 oz. of platinum metals. In addition it provided 75,438 oz. of gold and 2,364,049 oz. of silver, the latter figure being now higher than the production from the Cobalt district. The Levack mine resumed shipments in May 1937 for the first time since 1929.

The silver-cobalt industry of the Cobalt camp and near-by areas is declining in importance. The silver production is now less than 2 million oz., greater amounts now coming from the nickel-copper industry, while the output from auriferous quartz mines is increasing. Cobalt production also has declined to 220,860 lb. as compared with 623,096 lb. in 1936.

Among the minor metals it is to be noted that molybdenite production has restarted for the first time since the war. The Phoenix Molybdenite Corporation, Ltd., with a mine and mill in Bagot township, Renfrew county, shipped a concentrate of 25,500 lb. valued at $7,500, which found a market in England. Other molybdenite properties are being prospected and

developed. Zinc production is also recorded for the first time since 1930, concentrates being exported with an estimated recoverable zinc content of 120,004 lb.

The total value of the non-metallic minerals increased by almost 17 per cent. to $10,373,185, reflecting improvement in the industries dependent on the group. An interesting feature is the expansion of the nepheline syenite industry which is finding a ready use for the rock in glass manufacture on account of its high alumina content. Production from the mine in Methuen township, near Lakefield (Canadian Nepheline, Ltd.), was 15,422 tons valued at $121,481. Increased productions of graphite, gypsum and quartz were also noted, and the few declines in production were in the less important minerals. An increase in the production of natural gas to meet increasing demands was partly met from the new Brownsville field, Oxford county, which was turned into the pipe line on March 1. Petroleum production, with a total of 164,990 barrels, shows a slight increase since 1936.

Sierra Leone Mineral Production in 1937.—The following notes regarding the mineral industry in Sierra Leone during 1937 are taken from the *Annual Report of the Geological and Mines Department*. Minerals produced were, in order of their value, diamonds, iron ore, gold, platinum and chromite. Increased activity is reported from all the known mineral fields.

A record figure of 913,401 carats was established in diamond production, this being an increase of almost 300,000 carats over the 1936 output. An intensive prospecting and development programme was started during the year and several new areas of promising value have already been proved. The value of the diamonds produced in 1937 was over a million pounds sterling.

A record production of iron ore from the Marampa mines was also returned. Work was continued on the erection of powder-ore concentrating plant at Marampa and the extension of the loading and handling equipment at Pepel. Of great importance to the industry was the signing during the year of the Tonkolili Agreement between the Government and the Sierra Leone Development Company for the development and exploitation of the extensive iron-ore deposits in the Tonkolili area. Exports of iron-ore during 1937 amounted to 633,985 tons.

Production of gold was smaller than in previous years and it is thought that the peak of gold production has been passed. Despite intensive prospecting, no new deposits of value have been discovered, and existing deposits are gradually being

worked out. Approximately 50 per cent. of the gold was won by tributing methods and it is anticipated that the bulk of production in the future will come from such workings as more and more areas reach the stage when ordinary alluvial mining methods cease to be profitable. The total output of 35,706 fine oz. for the year 1937 was about 2,000 oz. below the 1936 figure.

A decrease was also shown in platinum production, the output being 308 fine oz. as compared with 489 fine oz. in 1936. Some prospecting was carried out on sands near York and Toke villages but results were not encouraging.

Trial shipments of chromite amounting to 729 tons are reported. The ore is, however, low grade and unsuitable for use in the ferro-chrome and chemical industries. Ordinary concentrating methods have so far failed to give a satisfactory product, but it is possible that a market may be found for the crude mineral in the refractories industry.

Statistics itemising the production and value of minerals obtained in the Colony and Protectorate during 1937 are shown in the following table, the total value of these minerals being £1,666,102.

MINERAL PRODUCTION AND VALUE, 1937

	Diamonds.	Gold (Crude and unrefined).	Platinum (Crude).	Iron Ore (Exports).	Chrome Ore (Exports).
	Carats.	*Troy oz.*	*Troy oz.*	*Long tons.*	*Long tons.*
First Quarter .	213,176	12,946	119	149,645	—
Second Quarter .	233,701	10,094	91	163,570	—
Third Quarter .	237,348	7,672	48	133,460	—
Fourth Quarter .	229,176	8,439	50	187,310	729
Total .	913,401	39,151	308	633,985	729
Value (£)	1,084,664	251,766	2,417	325,605	1,650

Newfoundland Mineral Production in 1938.—According to the statement received from the Acting Government Geologist, the total tonnage and value of minerals produced in Newfoundland in 1938 shows a decline as compared with 1937. The fall in tonnage was due mainly to a reduced output of limestone, which dropped by over 177,000 tons. The production of iron ore, however, increased by nearly 70,000 tons, and there were also small increases in the outputs of lead, copper and zinc concentrates. The production and values for 1938, together with the totals for 1937, were as follows:

	Year to December 31, 1938. Tons.	$
Iron ore	1,680,213	4,284,543·15
Limestone	187,480	188,480·00
Lead concentrates	47,119	1,342,326·48
Copper concentrates	32,865	1,466,879·06
Zinc concentrates	122,084	977,316·39
Gravity concentrates*	365	134,281·42
Fluorspar	14,000	84,000·00
Pyrophyllite	1,000	1,490·00
Total	2,085,126	$8,479,316·50
Total for 1937	2,178,970	$10,125,809·10

* *Auriferous and argentiferous concentrates of lead and zinc ore.*

A New Method of Working Placer Gold Deposits.—Although alluvial gold deposits have been worked by dredging for many years, the excavating equipment in practically all cases has been of the conventional connected-bucket type. During the last five years, however, an increasing number of dragline excavators have been installed and are reported to be giving very satisfactory service. A dragline dredge is a floating washing plant for auriferous gravel, fed by a dragline excavator, and recent developments in this type of working are described in an article entitled "Dragline Dredges—a New Way to Mine Placer Gold," by C. W. Merrill in *Mining and Metallurgy*, December, 1938, pp. 521-525.

The first experiment in dragline dredging of alluvial gold deposits was carried out in 1933 near Oroville, California, and was not at first successful. Later in that year another dredge of this type was erected on Wyandotte Creek, Butte County, California, and in succeeding years many more were installed until in 1937 gold to the value of over 3½ million dollars was recovered in California by dragline dredge working. The 1938 figures are expected to show a further increase.

Although the revival of the placer gold mining industry is due in large measure to the increase in the price of gold, it has been further promoted by the application of cheap modern power to moving gravel in the auriferous areas. The connected-bucket dredge method has been developed during the past forty years, but from time to time other methods have been employed, none of which, however, has been entirely successful. The latest innovation, dragline dredging, has, nevertheless, proved itself eminently suited for work under certain conditions. In less than five years the dragline dredge has become the second most important type of equipment for placer gold mining in the United States.

Dragline dredging equipment consists essentially of a washing plant floating on a hull of shallow draught and a dragline excavator operating from the bank of the stream or

pond. The hull and superstructure of the washing plant were formerly constructed of wood, but modern practice favours the use of steel on account of its greater ability to stand up to rough usage. The dragline equipment consists of a movable power unit, similar to a power shovel, upon which is mounted a long revolving boom. A bucket of the rugged scraper type specially designed for placer working is used and is loaded by dragging towards the power unit with a cable. When loaded, the bucket is hoisted by another cable to the required height and can then be swung to any position within the range of the boom. In practice the bucket is dropped into the pond and as it dredges up the gravel it cuts away the bank on which the power plant stands. Consequently the excavating plant must retreat as the pond advances towards it and the washing plant can be floated into the newly-made section of the pond.

The gravel from the bucket is discharged into a hopper high above the hull at the bow of the pontoon. On emerging from the hopper the gravel is met by powerful jets of water which break it up and help to provide a regular flow to the sluice-boxes. From the hopper the pay-dirt passes to a trommel where various devices are employed to free the gravel from clay, accelerate washing and promote disintegration of the gravel. The gold is recovered in riffle sluice-boxes and the tailing is discharged into the pond from the stern of the hull. The pontoon also carries pumps for delivering water to the hopper, trommel and sluice-boxes and the motors or engines required to drive the pumps.

In addition to delivering gravel to the washing plant, the dragline can be used for development work such as building dams and raising or lowering the level of the pond in order to gain access to new gravel beds.

Dragline methods are employed to work deposits not economically workable by other means. Hydraulicking methods are still employed where the topography is rugged and where there is a plentiful supply of water which can be allowed to run to waste after use without contravening local mining laws. Low-grade gravels of wide area and considerable depth are worked most economically by connected-bucket dredges. The dragline dredge, however, is most likely to give satisfactory results when (*a*) the deposit is not more than 20 ft. thick, (*b*) the top of the bedrock is soft enough to be taken up with a dragline bucket, (*c*) the gravel is loose enough to be handled by a dragline, (*d*) the gravel is free or virtually free from large boulders, and (*e*) the gold content per cu. yd. is at least 50 per cent. above that required for the profitable operation of large connected-bucket type dredges. Further advantages of dragline dredges over connected-bucket dredges are their greater mobility and their much lower initial cost.

Deposits that have been worked by dragline dredges have usually been small, shallow, high in clay and variable in gold content. Larger and more uniform deposits are more economically worked by connected-bucket dredges.

A number of disadvantages of dragline dredges must be mentioned. One of the most serious is that the bedrock is not always cleaned efficiently. General working costs are higher than with connected-bucket dredges, although it is anticipated that further experience and experiment will succeed in reducing costs. Despite these and other obvious disadvantages, however, the significant fact remains that this new method of winning placer gold has made available for exploitation many bodies of gravel for which no profitable working method was known five years ago.

Gold in Kavirondo, Kenya.—An interim report by Dr. W. Pulfrey of a geological survey of the South-West Quadrant of the No. 2 Mining Area in Kavirondo has recently been published as *Report No. 7 of the Kenya Mining and Geological Department.* The area dealt with, which is the No. 2 Area of the Kitson Report, is bounded on the north by the Yala river, on the west by the shore of Lake Victoria, on the south by a line running across the base of the Uyoma Peninsula, and on the east by a north-south line through the north-west corner of the Kavirondo Gulf.

The greater part of the area is occupied by members of an ancient volcanic series, styled the Pre-Kavirondo Volcanic Suite, which is invaded by a number of granite masses (Younger Granite) and by many minor intrusives of various types. In the Uyoma Peninsula there are overlying Tertiary volcanics and sediments. Outcrops of the Basement Complex are relatively small.

After a detailed account of the geology there follows an important section on mineral resources, which in this area are confined to gold. Gold has been found in many parts of the area and is being worked by a number of syndicates, large and small. Gold production in this quadrant of the No. 2 Area has been relatively high, and since it was opened to prospectors in May 1934 over 20,000 oz. of gold have been produced. It is stated that several properties now show promise of becoming established producers, and it is evident that the possibilities of other portions of the area have been by no means fully exploited.

All the gold deposits of the area consist of quartz veins or rubble derived from the disintegration of quartz veins. Sulphides are usually present and these consist of pyrite, chalcopyrite, galena, and sometimes mispickel. The size and disposition of the veins is very variable, thicknesses varying

from a fraction of an inch to about 10 ft. The average thickness of the workable veins probably lies between 15 and 24 in. The strike extent ranges from about 100 ft. to a maximum of about 1,500 ft. The distribution of gold in the veins is in some cases sporadic, but in several mines appears to be concentrated in shoots. In all cases it seems that the gold is largely confined to the main vein structure in any one vein system. Moreover, values are not in general found in the wall-rocks of the veins, though at a few of the mines low-grade wall impregnations have been noted.

The localities of the gold workings are shown on a separate sketch map, from which it is seen that the majority occur in restricted areas, in close proximity to the major acid or sub-acid intrusives.

The report concludes with descriptions of twenty properties in the area which were being worked or developed during the course of the survey, and contains a geological map on a scale of 1 in. to the mile.

Development in Empire Tungsten Production.—The increasing demand for tungsten during the last few years has led to a new interest in Empire sources, which has already produced notable results. World production has risen rapidly since 1932, and in 1937 amounted to about 34,500 long tons (reduced to a basis of 60 per cent. WO_3), as compared with the former record of 31,400 tons for 1918. Of the 1937 total, China contributed about one-half, and the British Empire roughly one-quarter. The persistent fear that Chinese supplies might be cut off as a result of the Sino-Japanese war has undoubtedly had a powerful influence on the industry.

Burma is the most important Empire producer of tungsten ores, and in 1937 accounted for 67 per cent. (4,998 tons) of the Empire's output, this being a record over the previous maximum in 1917. The ore is essentially wolframite and is usually obtained together with tinstone, the region in which it occurs being a continuation of the Malayan tin belt, although distinctive in its tungsten mineralisation. The foremost producers are the Hermingyi mine near Tavoy and the Mawchi mine in the Karenni Hills, the Mergui and Yamethin districts also contributing considerable amounts.

During the last three years Malayan production has decreased, largely owing to the falling off of supplies from the Kramat Pulai scheelite mine.

Australia showed a big increase in production in 1937, with a total of 738 tons of concentrates, and in 1938 this amount had been exceeded by the end of September, so that it is probable that Australia will displace Malaya as the second Empire producer. The main developments have been in the

Northern Territories and Tasmania. In the former State there has been considerable activity in wolfram mining around Alice Springs, where there are three fields, Hatches Creek, Wauchope and Mount Hardy. Although only the most primitive mining methods were employed, the district produced 291 tons of wolfram concentrates in 1937. At Hatches Creek 180 men were engaged in the middle of that year, and some rich wolfram reefs were reopened in old underground workings. The Wauchope field has exceptionally rich ore but is severely handicapped by lack of water, which has usually to be carried 8 miles from the nearest well. In July 1937 about 150 men were working there, but entirely without machinery. A little alluvial wolfram was won at Mount Hardy, but there has been practically no reef-mining at this locality.

In north-eastern Tasmania tin-tungsten mining has been active in the Avoca field, where it is estimated that since 1872 no less than 2,000 tons of wolfram concentrates have been produced. At the Storey's Creek mine, the present largest producer, considerable improvements have been made to the plant, and wolfram lodes, previously neglected when tin was the principal mineral sought, are now being developed. In 1937, 11,736 tons of ore were milled and produced 239 tons of wolfram and 27 tons of cassiterite. The Aberfoyle mine, in the same field, is essentially a tin mine, milling 250 tons of ore a week, which averages 1½ per cent. tin and 0·2 per cent. tungstic acid, the production of wolfram in 1937 being 35½ tons.

Another important development in Tasmania has taken place on King Island, in the Bass Strait, where scheelite mines at Grassy have been reopened. These mines were worked between 1917 and 1920, in which period they produced 589 tons of scheelite concentrates from some 68,000 tons of ore; when they closed in 1920 the proved reserves stood at 50,000 tons of ore. These reserves have been substantiated by a re-examination of the property with the aid of diamond drilling, and five ore-bodies have been proved, striking east-west and dipping south at 20° to 30°. The ore-bodies are bands of coarse-grained garnet rocks carrying about 1 per cent. of scheelite, and occurring as contact replacements in a series of slates and shales not far from a granite mass which is exposed to the south. Production started from open-cut workings in June 1938; by November, 500 tons of ore yielding 2¼ tons of concentrates were being treated per week, and it was proposed that the plant should be increased to treat 1,000 tons per week as and when results warranted this change.

Queensland has several small producers in the Cairns district, and in 1937 produced 98 tons of wolfram and 2 tons of scheelite concentrates. The Mount Perseverance field, 54

miles north of Cairns, attracted small workers and early in 1938 about 50 were working there, but as yet activity is localised in a belt only 2½ miles long and ½ mile wide. Victoria has no recorded production of tungsten in recent years, but prospecting has revived in the North-Eastern Province around the Murray River about 40 miles upstream from Albury. Scheelite-tin ores were worked here near Koetong during the war, and recently complex wolfram-sulphide-tin ores have been worked at Thologolong, and the concentrates are believed to be acceptable in spite of their complex nature.

In New Zealand the most important source of scheelite is in the Glenorchy district at the head of Lake Wakatipu in north-western Otago. The industry flourished here during the war, but subsequently mining was negligible until the recent interest in tungsten called attention to the field in 1934. Since then most of the old claims have been reopened and prospected further along the lodes. The mines are situated in mountainous country in a belt 20 miles long and 12 miles wide extending north-eastwards from the head of the lake. Several of the higher mines are difficult of access, and workable only in summer when the snows have melted, so that only rich ore is brought down from them. The scheelite is in quartz lodes carrying some pyrite and arseno-pyrite and a very little cassiterite and gold, occurring in quartz-mica-schists. Mining methods are primitive, and the general treatment consists in crushing the ore (after roasting if pyritic), jigging, and concentrating on Wilfley tables. Hitherto alluvial scheelite has been recovered from the gravels in Buckler Burn and Temple Creek by fossickers, but mining companies are now also investigating the area and extensive developments are foreshadowed.

Tungsten mining has developed considerably in Southern Rhodesia during the last four years, and in 1938 production to the end of November reached the record figure of 278 tons of concentrates with a record production during that month of 50·93 tons. While several mines have contributed to the production most of them are still in the development stage or have yet to perfect their concentration processes. In the Essexvale district near Bulawayo, the Sapphire Blue and Lo Matchie mines worked ores with as much as 3 per cent. scheelite, and although there were considerable losses during concentration at first, it was believed that these could be eliminated. In the Mazoe district a new mine called the Mazoe Scheelite King mine began production in 1937. This should not be confused with the Scheelite King mine near Gatooma, which is also producing. The Golden Valley mine, Gatooma, produces scheelite as a by-product of gold mining. The Hippo scheelite claims located in 1937 in the Sabi River gorge near Chipanga

began production in 1938, and produced 3·35 tons of concentrates in October. The St. Swithins Ores and Metals, Ltd. produce wolframite at the Sequel Mine at Tshontanda in the Wankie district, and also operate the Nevada claims 60 miles from Bulawayo and the Beardmore scheelite claims in the Victoria district.

Prior to 1936 tungsten production in the Union of South Africa was almost negligible, the highest recorded output being 17 tons of concentrates in 1918. In 1936, however, production rose to 29 tons, in 1937 to 34 tons, and in the first eleven months of 1938 to 102 tons. The principal source is scheelite got by individual diggers in the Steinkopf native reserve, Namaqualand, from small quartz veins carrying tourmaline and scheelite and associated with pegmatites. Taken over the entire workings, none of the veins average more than 1 per cent. scheelite, but the mineral has been got cheaply from rich pockets near the surface, and since the ore is coarse enough to be hand-sorted, no concentration process is required. Richer deposits occur at Xochasib on the Orange River, where 620 tons of ore averaged 2·4 per cent. scheelite. In February of last year a new company was developing deposits in the Uppington district of Gordonia, and plant was being erected.

Tanganyika is a new addition to the ranks of the smaller Empire producers, which include South-West Africa, Nigeria and Uganda. Wolfram was first discovered there in 1934 near the Karagwe tinfields, and to the end of October 1938 about 27 tons were produced. Output is from the Kibanda claims, situated 18 miles by a rough motor track from Muronga, where wolfram occurs in quartz veins and greisens in a small granite cupola, some sections of the reefs averaging about 2 per cent. wolframite.

Magnesium in Incendiary Bombs.—Many types of incendiary bombs are known, varying in size, weight, and penetrating power. Recent experimental work, however, has shown that the type likely to be most effective in warfare is light, weighing only one kilogram and consisting essentially of magnesium metal. A large bomber could carry 1,000 to 2,000 of such bombs and could discharge them over a wide area, thus causing numerous fires and widespread confusion among the civilian population.

The kilo-magnesium bomb, as it is called, is described by A. R. Astbury (*J. Soc. Chem. Ind., Lond.*, 1939, **58**, 43) as consisting of a thick-walled tube, 9 in. long and 2 in. in diameter, made of an alloy containing approximately 93 per cent. of magnesium and 7 per cent. of aluminium. The tube is filled with a priming composition of the thermit type which

requires no external supply of oxygen for combustion. The nose of the bomb is usually flat and a tail about 5 in. long is affixed to the other end to keep it steady in flight.

On impact, the priming composition ignites spontaneously and burns at a temperature of 2,500° C. for 40 to 50 seconds, which is sufficient time for the magnesium tube to melt and ignite. The molten magnesium burns for 10 to 20 minutes at a temperature of about 1,300° C. The bomb is not explosive but a high pressure in the tube is developed by the combustion of the thermit, and when the walls begin to melt jets of flame spurt out and small pieces of burning magnesium may be projected as far as 50 ft. from the point of impact.

When released from sufficient height the bomb will penetrate roof coverings such as tile, slate and corrugated iron. It is so designed that it does not penetrate further, but comes to rest and starts fires in attics and upper rooms of houses.

Polish Coal Situation.—The position of Poland in the European coal economy as a result of the acquisition of the Olza district of the Czechoslovakian Ostrava-Karvinná coalfield is even yet not absolutely clear, but a degree of light has been shed upon the problem in a recent article (*Coll. Guard.*, 1939, **158**, 59-63).

From being in 1937 Europe's fourth largest producer of bituminous coal, Poland, by the addition of the output from the Olza district, has now attained approximate parity with France, the nation ranking third on the basis of 1937 output.

Bituminous Coal Output for 1937

(*Million long tons*)

United Kingdom	234·07	Poland . . .	35·64
Germany . .	181·59	Czechoslovakia .	16·68
France . .	43·61		

The actual tonnage addition amounts to about 20 per cent., but the exportable surplus is increased by over 40 per cent.

The Olza district, formerly the Czechoslovakia communes of Cieszyn, Frystat, and part of Frydek, lies on the north-west fringe of the West Beskid Mountains and to the west of the Olza river. The actual frontier has not been decided upon, but it is not expected to be essentially different from that of November 1, 1938, the area comprising about 1,300 sq. km., which by the census of 1930 supports a population of 343,000. This is more than half of the original Ostrava-Karvinná field.

Mining is carried on in the district by five mining groups: the Towarzystwo Gorniczo-Hutnicze, the Witkowickie Gwarectwo Hut i Kopaln Welga, the Gwarectwo Orlowa-Lazy, the Hrabia Larisch-Mönnich, and the Dyrekcja Kopaln "Eugeniusz" i "Waclaw" in Pietwald. The last named was

controlled by the Czechoslovak State, while the Gwarectwo Orlowa-Lazy is owned by Czechoslovak capital through the semi-State Bank Zivnostenska, and the Witkowickie Gwarectwo is controlled by the Rothschilds of Vienna and London. The Hrabia Larisch-Mönnich is the property of Count Johann Larisch and 70 per cent. of the Towarzystwo Gorniczo-Hutnicze is held by the Schneider Creusot group.

Production of Coal, Coke and Briquettes by Companies in Karvinná District ceded to Poland

(*Thousand tons*)

Coal.	1934	1935	1936	1937	1938 (Jan.-Aug.)
Gornicza . . .	1,778	1,799	2,131	3,014	1,866
Larisch-Mönnich .	883	891	1,029	1,526	914
Orlowa-Lazy . .	899	955	1,075	1,579	989
State Mines, Pietwald .	485	502	548	579	377
Witkowickie . .	338	336	442	653	370
Total .	4,383	4,483	5,225	7,351	4,516

Coke.	1934	1935	1936	1937	1938 (Jan.-Aug.)
Gornicza . . .	237	283	393	663	383
Larisch . . .	72	96	117	174	106
Orlowa-Lazy . .	86	77	115	237	101
State . . .	76	84	83	81	54
Total .	471	540	708	1,155	644

Briquettes.	1934	1935	1936	1937	1938 (Jan.-Aug.)
Gornicza . . .	64	63	60	70	43
State . . .	10	37	39	39	26
Total .	74	100	99	109	69

The coal in this district is won from seams which are generally thinner than those of the main part of the Silesian basin to the north, averaging only from 1·4 to 1·8 metres, except where folding has produced thickening at the saddles. Most of the seams are of a gaseous nature.

The output is divisible broadly into two groups: (*a*) domestic and steam coal; (*b*) gas and coking coal, a blend of which furnishes excellent bunkers. The mines producing the first class of coal are Postep, Jadwiga, Zofia, Sucha, Nowy and Eugeniusz, and the first- and last-named also produce briquettes; gas and coking coals are obtained from the Barbara, Jan, Franciszek, Gleboki, Bettina, Hohenegger, Waclaw, Eleonora, and Gabriela.

From these mines Poland now possesses an output of coal for which there is no large home demand, and accordingly must be added to the production for export. Hitherto this coal and the coke therefrom have been employed largely in Czechoslovakia and also exported principally to Austria and Italy,

but with the national re-orientation of Central Europe it is doubtful whether Poland can retain any large proportion of the former Czech markets. Certainly much of the coke manufactured in the Olza district and once used extensively in Czechoslovakia will need to find a new outlet. [The foregoing was written prior to the events of mid-March 1939.]

Progress in British National Coal Survey Work.—The Report of the Fuel Research Board for the year ended March 31, 1938, presents a comprehensive account of the progress made by the Fuel Research Station, Greenwich, and the eight Coal Survey Laboratories, on the various problems relating to coal in the United Kingdom.

The work carried out under the Board's supervision is broadly divisible into two groups, namely: (1) research into the utilitarian aspects of coal such as preparation for the market, carbonisation, gasification, steam generation, domestic heating, synthetic oil production, and (2) methods of analysis (which are carried out at the Board's main station at Greenwich) and the actual physical and chemical surveying of the coal seams done in the laboratories on the respective coalfields by a standardised technique permitting of accurate comparisons being made.

Up to the present these Survey Laboratories, which are located in Glasgow, Newcastle upon Tyne, Leeds, Sheffield, Nottingham, Chester, Birmingham and Cardiff, have carried out complete surveys on 65 seams and work on 30 others is in hand. This by no means represents even one-half of the seams in Britain being actively exploited, but affords reliable data on approximately 30,000 million tons of coal. The normal method of analysis consists in taking complete pillar samples of a particular seam at as many collieries as are indicated by its major characteristics and areal disposition, the basis of the selection being initially such data as the individual coal companies have available. Detailed physical and chemical analyses of these seam pillars, which, incidentally, are not obtained without a great deal of labour and skill on the part of both the miner and the laboratory assistant, then enable the properties of the coal as yet unworked to be forecast with a reasonable degree of accuracy. On occasion apparent gross differences in the physical and chemical compositions reveal the fact that erroneous correlation has been made as between the seams of one district and another. Additional work undertaken by the Laboratories includes the sampling and analysis of pit-head coal and of borehole samples, the investigation of coal breakage during transport and storage, and of sizing operations to meet definite market requirements.

At Greenwich, in studying the problem of eliminating the nuisance caused by dusting, particularly in the handling of

large quantities, it has been determined that oils of high molecular weight or high viscosity have a positive and persistent effect in suppressing dust production. A large-scale plant has now been installed whereby coal may be sprayed with oil under pressure at rates up to 6 tons of coal per hour.

Coking trials are being carried out with a view to producing metallurgical types of coke from blends of coking coals and feebly-caking coals.

Research of prime importance is also continuing on the synthesis of hydrocarbons from carbon monoxide and hydrogen and has now reached a semi-technical scale. The Research Station plant has a capacity of 100 to 150 cu. ft. of synthesis gas per hour, and special attention has been paid in the year under review to the production of lubricating oils by polymerisation of the unsaturated components of the primary synthesis product. The oil obtained exhibits good characteristics except that its resistance to oxidation is not up to the standard of the Air Ministry specification.

Amongst other items of interest work is now in progress on the operation of a diesel engine on powdered coal. A major difficulty has proved to be the high degree of wear suffered by the liner, piston, and rings in the expansion and exhaust strokes due to the coal ash and unburnt coal particles forming an abrasive paste with the lubricating oil. In the case of the cylinder liner, wear is almost entirely confined to the ring track and is at a maximum at a point slightly below top dead centre, whilst piston wear is mainly on the thrust faces, and ring wear most severe in the top member. The rate of wear has proved to be more than twice as great with dull coal (durain) fractions as with bright (vitrain or clarain) fractions.

The Use of Diatomite in the Manufacture of Pigments.—A recent patent (*Brit. Pat.* 488,860 of 1938) describes the manufacture of various iron oxide pigments by mixing iron sulphate or chloride with diatomite, ground quartz, or flint, and heating the mixture either with or without admission of air at a dull red heat until the iron compound is decomposed. Variations in colour are obtained by modifying the roasting procedure and the materials used.

Thus ferrous sulphate with diatomite yields a pigment with an orange undertone, while with ground quartz or ground flint a claret-coloured undertone is produced. If diatomite is roasted with ferric chloride a purple-coloured pigment is produced, but on heating in the absence of air with ferrous sulphate the product resembles raw sienna.

The proportions of diatomite to iron sulphate may vary from 1 : 1 to 0·13 : 1, variations in the tint of the product being obtained by this means.

BOOK REVIEWS

Books for review should be addressed to "The Editor," Bulletin of the Imperial Institute, South Kensington, London, S.W.7.

THE WORLD COAL-MINING INDUSTRY. Volume I. Economic Conditions. Pp. vii + 258, $9\frac{1}{2} \times 6\frac{1}{4}$. Volume II. Social Conditions. Pp. viii + 372, $9\frac{1}{2} \times 6\frac{1}{4}$. International Labour Office, Studies and Reports, Series B (Economic Conditions), No. 31. (Geneva: International Labour Office [League of Nations]; London: P. S. King & Son, Ltd., 1938.) Price 8*s*. per volume.

An attempt has been made in this two-volume publication from the International Labour Office at Geneva to furnish a conspectus of the economic and social conditions prevailing in the coal-mining industry with special reference to their relation to the problem of hours of work in coal mines.

Volume I, treating of economic conditions, gives a remarkably good summary in the first four chapters of the "coal problem," which as a sales war was in existence even in the seventeenth century; the confines of coal mining practice and employment; the role of coal in the industrial economy; and the geographical localisation of coal production by countries and coal-types. The major issue is reached, however, in Chapter 5, where the question of "surplus capacity" is considered and attributed mainly to depressed railway demand, the conversion of an increasing tonnage of the mercantile marine to oil-firing and internal combustion, and greatly increased efficiency in thermo-electric generation and steam-raising plants generally, together with such contributory causes as restricted world trade and the higher proportion of scrap used in iron and steel manufacture. In referring to hydro-electric power production the Report adopts the view that the expansion of this phase of industry not merely satisfies a demand for power which would not have arisen in circumstances other than those solely capable of being satisfied hydro-electrically, but creates a demand for heat and power which may be met in part at least by coal. That a considerable measure of doubt can be thrown on this concept is evidenced by the fact that the extension of hydro-electric power generation in Canada, particularly, has in no way stimulated a demand for greater supplies of Dominion coal. Surplus capacity it is pointed out is also concerned with the inelasticity of the coal trade in meeting variable demand, the mechanisation of mining. operations, and the new possibilities of utilising small sizes of coal. Of recent years surplus capacity has been estimated as equivalent to 46 per cent. of the annual tonnage raised.

World trade in coal forms the thesis of Chapter 6, in which trading relationships and post-war market changes are dealt with, and attention is called to the re-orientation of European markets in post-War years, principally in favour of the German Reich and largely at the expense of British exporters.

The three concluding chapters of this volume are devoted to factors such as special types and grades, availability, accessibility to markets, labour costs, and government assistance schemes, which influence the successful marketing of coal; the effect of marketing struggles and reduced demand upon prices, costs, profits and labour standards, particularly between 1929 and 1936; and the movement towards integration of colliery enterprises and public regulation of the industry as a whole.

The social conditions of the industry throughout the world are considered in Volume II, the main features being labour supply, wages, employment, compensation for accidents and industrial diseases, health and unemployment insurance, pensions, statutory holidays, and hours of work.

In brief, some 4½ million persons are gainfully employed in the coal-mining industry throughout the world, of whom 2¼ millions are engaged underground. Female labour is negligible except in U.S.S.R., British India and Japan where the relative proportions are 22, 14 and 10 per cent. respectively. The extreme ratio of earnings on a comparable gold basis was 12 to 1 as between U.S.A. and Japan in 1936, and has shown an increasing divergence since 1929, not owing to any increase in wages but to a severe reduction in Japanese remuneration rates between 1929 and 1933.

The employment statistics reveal the interesting fact that in addition to the decrease in the volume of employment since 1929 in all the principal coal-mining countries, recruitment for the trade is steadily declining. The question of regulation holidays is still everywhere a vexed one and there is little uniformity except for the weekly intermission which is generally a period of 24 hours on Sunday.

The publication as a whole presents an excellent and authoritative conspectus of coal-mining throughout the world, and constitutes an invaluable work of reference, both volumes of which are indexed and carry a profusion of tables and graphs.

Statistical Year-Book of the World Power Conference: No. 3. Data on Resources and Annual Statistics for 1935 and 1936. Edited by Frederick Brown, B.Sc.(Econ.), F.S.S. Pp. 138, 11 × 8½. (London: The Central Office, World Power Conference, 1938.) Price 20s.

The issue of the third number of the Statistical Year-Book which is devoted to correlative data on a world-wide scale

for the years 1935 and 1936, apparently indicates that the system of collection is functioning with increasing efficiency, but a lamentable dearth of information in many countries continues to be evident.

Innovations in this issue include a table devoted to the areas and populations of the countries for which statistics are furnished, information previously being only partially incorporated; a section relating to manufactured fuels other than coke, and a table giving statistics of production and consumption of electricity during 1935. An attempt has also been made to incorporate statistics for Iceland and Portugal generally throughout the volume.

Considering the information supplied in its entirety, the main interest attaches itself to the chapters on wood, gas, water power and electricity, which furnish statistics not usually readily procurable. Apart from minor adjustments in such countries as Bulgaria and Norway, there is only one marked change in the national forest reserves, namely, in Canada, where the total forest area is now quoted at 285 million hectares as compared with 324 million quoted in the previous report, both figures being reported as for 1937. Gas production has shown no marked increase as between 1935 and 1936, though the augmented production from coke ovens in Germany was to be expected from the 20 per cent. advance in production of pig-iron which took place there in the latter year. Water-power resources similarly are the same for 1936 as 1935, but in the section relating to electricity the 1936 production table for supply undertakings is considerably reduced in value by the absence of figures for Germany, the U.S.S.R., Great Britain and Canada. From such data as is available it is apparent that the employment of electricity for all purposes is becoming ever more general.

The new Year-Book is an improvement on the previous edition, but the gross lack of statistics of any utility in many countries of the world is still regrettably apparent.

INTRODUCTORY ECONOMIC GEOLOGY. By W. A. Tarr. Second Edition. Pp. xi + 645, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1938.) Price 30*s*.

The first edition of this text-book appeared in 1930, and was noticed in this BULLETIN, 1931, **29**, 106. In general the present text follows closely that of the previous edition, but several sections have been brought up to date and certain additions made, despite the fact that the book has been shortened by a few pages. The work is intended for American students, and so deals at length with American deposits; other occurrences, however, are treated briefly and indeed often dismissed as a mere list of countries producing the mineral,

so that many of the world's classic and most important mineral deposits receive inadequate attention. English readers will further notice inaccuracies such as the inclusion of the Federated Malay States, Siam, Burma and India in the "Straits Settlements," the statement that the Cleveland Hills is the most important iron producing area in Great Britain, and that "rarely, clay underlies coal." In spite of these defects, however, Professor Tarr's book contains a great deal of information covering practically the entire field of economic minerals. The section on ferro-alloy metals has been considerably increased, and innovations include sections on beryllium, and on olivine and kyanite as refractories. It is gratifying to note that his final topic, vermiculite, now receives one and a half pages as compared with one and a half lines in the previous edition.

FIELD DETERMINATION OF ROCKS. By E. H. Davison, B.Sc., F.G.S. Pp. viii + 87, $8\frac{3}{4} \times 5\frac{1}{2}$. (London: Chapman & Hall, Ltd., 1938.) Price 7*s.* 6*d.*

This comprehensive little book forms an admirable companion volume to Mr. Davison's earlier work entitled *Field Tests for Minerals*, and in a similar manner presents the novice with sufficient easily assimilable knowledge to derive both profit and interest from geological field work.

The first of the six chapters constituting the book is quite brief and devoted to the rudiments of field work, principally the equipment necessary for successful work.

Attention is next turned to the rock-forming minerals, grouped into primary types, essential, such as quartz, felspars, felspathoids, micas, pyroxenes and amphiboles; and secondary including garnets, tourmaline, fluorides, apatites, titanium minerals, etc.; then a secondary group defined as commonly products of alteration of pre-existing minerals. The minerals of this latter group are the chlorites, serpentine, talc, kaolinite, zeolites, carbonates and sulphates, but not the metamorphic minerals.

A short third chapter follows giving a broad classification of the igneous rock types in the field, and definitions of the nomenclature employed in referring to the commoner forms in which such rocks occur, namely, amongst others, batholiths, dykes, cone sheets, veins, pipes and necks, together with a brief reference to rock structures.

The main structure of the book, however, is founded on the ensuing three chapters on the origin and classification of igneous rocks, the secondary or sedimentary rocks, and metamorphism. In the first of these a brief indication is afforded of the supposed basic stratification of the earth's crust into

sial and sima, and of the reasons for the choice of a method of classification based on rock texture and mineral assemblage. Tables are given showing rock types and their usual essential and accessory minerals and the minerals which may ordinarily crystallise from acid and basic magmas of given composition, and then follows a consideration of the igneous rock types.

The sedimentary rocks are also described succinctly, and a table is added in which the grouping is of mechanically, chemically, and organically formed rocks into siliceous, argillaceous, calcareous and "other composition" types. Exception may be taken to the inclusion of "tundra" and peat as rock types (p. 56) and the Scottish oil shale is certainly not a Torbanite (p. 62), which term is reserved for a special variety found only at Torbane Hill west of Edinburgh and possessing an oil content greatly in excess of that now being worked. The supply of Torbanite, so-called, was exhausted many years ago. Again Curaçao is not considered one of the most important localities supplying phosphate rock (p. 65) since the Netherlands West Indies in 1937 ranked tenth amongst world producers.

The final chapter on metamorphism calls for no comment dealing as it does with generally accepted concepts and classifications, but the book itself, viewed by and large, includes far more petrogenetics than is conveyed by its title.

As in the author's previous work, many admirable illustrations have been incorporated, as well as an index, and the printing and binding of the book are in excellent style.

ASPHALTS AND ALLIED SUBSTANCES. By H. Abraham. Fourth Edition. Pp. xxiv + 1,491, 9 × 6. (London: Chapman & Hall, Ltd., 1938.) Price 60s.

The first edition of this well-known book was published in 1918, the second in 1920, and the third in 1929 (reprinted 1932). A notice of the latter edition appeared in this BULLETIN (1930, **28**, 405). The new edition is greatly enlarged, comprising 1,491 pages, as compared with 891 pages in the previous edition, and reflects the great developments in the technology of asphalt and allied materials which have taken place in the last decade.

For greater convenience the author has segregated the references in a very comprehensive appendix. This is preceded by the bibliography, now much more extensive than in the previous edition.

In the six parts into which the book is divided, the author has endeavoured to cover every aspect of his subject, from the simple applications of asphalt in very early days, to the enormously diverse and specialised practices of modern times,

and has dealt in a most interesting manner with the long history of the material. The historical review is followed by chapters on terminology and classification, chemistry, geology and origin, and production of bituminous substances.

Part II gives a very adequate account of the methods of mining, transporting and refining asphaltic materials, both in America and in other countries, and contains many relevant maps, figures and photographs.

Tars, pitches, and pyrogenous asphalts form the subject of Part III, and here the author shows clearly the essential differences between the products obtained from various raw materials by thermal treatment.

Part IV deals with pyrogenous asphalts and waxes, and concludes the parts of the book in which the fundamental materials used in industry are considered.

Part V, comprising 244 pages, deals in a very wide and comprehensive manner with manufactured products and their uses.

Part VI, which deals with methods of testing, takes up almost one-third of the book, and when the next edition appears might usefully be issued as a separate volume.

This comprehensive treatise is well printed and illustrated, and can be regarded as indispensable to those interested, as producers, users, or testers, in the many asphaltic and allied materials.

Geology for Engineers. By Brigadier-General R. F. Sorsbie, C.B., C.S.I., C.I.E. Pp. xxii + 348, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: G. Bell & Sons, Ltd., 1938.) Price 12*s.* 6*d.*

This book is a second edition of the author's well-known work, published in 1910, the original text having been largely rewritten and rearranged. A knowledge of geology is very desirable for those seeking to enter the profession of civil engineer, and this book, specially written for engineering students, will be found to supply their wants in an admirable way. More advanced students will find that its numerous and carefully selected references will prove of considerable value in following up particular aspects of the subject.

Part I deals with dynamical and structural geology, and describes various minerals and rocks of interest to the engineer. Part II is devoted to field work such as geological surveying. Part III dealing with applied geology, contains chapters on clays, limes, cements, plasters, roads and canals, rivers, coast erosion, drainage and reclamation of land, soils and sites for buildings and uses for minerals.

The book is well indexed, attractively printed, and its price is well within the reach of the great majority of students.

APPLIED GEOPHYSICS IN THE SEARCH FOR MINERALS. By A. S. Eve, C.B.E., M.A., D.Sc., F.R.S.C., F.R.S., and D. A. Keys, M.A., Ph.D., F.R.S.C. Third Edition. Pp. x + 316, $8\frac{1}{2} \times 5\frac{1}{2}$. (Cambridge: The University Press, 1938.) Price 16*s.*

Standard works on geophysical prospecting methods applicable both to active practicians in the subject and to students are by no means common and accordingly a third edition of such an appropriate volume as that by Eve and Keys constitutes a very welcome addition.

Generally, the lucidity of the text and clarity of the illustrations have been well maintained, and the account of recent progress in the science (Chapter VIII), which treats of new methods such as the Schlumberger electrical coring technique, further advances the utility of the book.

A useful select bibliography and a good index are also included.

BOOKS RECEIVED FOR REVIEW

ALUMINIUM. Its History, Metallurgy, and Uses, with Projects for the School and Home Shop. By Douglas B. Hobbs. Pp. viii + 295, 9×6. (Milwaukee, Wisconsin, U.S.A.: Bruce Publishing Co., 1938.) Price $3.00.

PRINCIPLES OF FLOTATION. By Ian W. Wark, Ph.D., D.Sc. Pp. 346, 9×6. (Melbourne: Australasian Institute of Mining and Metallurgy (Inc.); London: The Technical Bookshop, 1938.) Price 21*s.*

FLOTATION PLANT PRACTICE. By Philip Rabone, A.R.S.M., D.I.C., Assoc.Inst.M.M. Third Edition, revised and enlarged. Pp. xiii + 184, $8\frac{3}{4} \times 6$. (London: Mining Publications, Ltd., 1939.) Price 12*s.* 6*d.*

A MANUAL OF RADIOACTIVITY. By George Hevesy and F. A. Paneth. Second Edition, completely revised and enlarged. Translated by Robert W. Lawson. Pp. xvi + 306, 9×6. (Oxford: Oxford University Press; London: Humphrey Milford, 1938.) Price 17*s.* 6*d.*

GEOLOGY OF INDIA. By D. N. Wadia, M.A., B.Sc. Second Edition. Pp. xx + 460, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: Macmillan & Co., Ltd., 1939.) Price 24*s.*

DISRUPTED STRATA. Faulting and its Allied Problems from the Standpoint of the Mine Surveyor and Stratigraphist. By M. H. Haddock, F.G.S., A.M.I.M.E. Second Edition. Pp. xvi + 104, $9\frac{3}{4} \times 6\frac{1}{4}$. (London: The Technical Press, Ltd., 1938.) Price 16*s.*

METALS. By Sir Harold Carpenter, M.A., A.R.S.M., Ph.D., D. Met., D.Sc., F.R.S., and J. M. Robertson, Ph.D., D.Sc., A.R.T.C. Volume I. Pp. xxii + 823; Volume II. Pp. xii + 825-1485, $9\frac{3}{4} \times 6\frac{1}{4}$. (London, New York, Toronto: Oxford University Press, 1939.) Price 105*s.*, the two volumes.

BIBLIOGRAPHY

Comprising the more important reports, articles, etc., contained in mineral publications received in the Library of the Imperial Institute during the three months, November 1938-January 1939.

The publications issued by the Governments of the Colonies and Protectorates can be obtained from or through the Crown Agents for the Colonies, 4 Millbank, Westminster, S.W.1. Applications for Dominion and Indian Government publications may be made to the Offices of the High Commissioners or Agents-General in London.

OFFICIAL ANNUAL REPORTS

Reports of H.M. Inspectors of Mines and Quarries under the Quarries Act, 1894, and the Metalliferous Mines Regulation Acts, 1872 and 1875, for the year 1937. Pp. 64, $9\frac{1}{2} \times 6$. (London: H.M. Stationery Office, 1938.) Price 1*s.*

List of Mines in Great Britain and the Isle of Man, 1937. *Dep. Mines U.K.* Pp. 334, $9\frac{1}{2} \times 6$. (London: H.M. Stationery Office, 1938.) Price 10*s.*

Gold Coast Colony: Report on the Geological Survey Department for the financial year 1937-1938. Pp. 30, $13 \times 8\frac{1}{4}$. (Accra: Government Printing Department [Publications Branch]; London: Crown Agents for the Colonies, 4 Millbank, S.W.1, 1938.) Price 2*s.*

Nigeria: Annual Report on the Geological Survey Department for the year 1937. Pp. 26, $13 \times 8\frac{1}{4}$. (Lagos: Government Printer, 1938.) Price 2*s.* 6*d.*

Preliminary Report on the Mineral Production of Ontario in 1937. Prepared by A. C. Young. *Bull. No.* 117, *Ont. Dep. Mines.* Pp. 36, $10 \times 6\frac{1}{2}$. (Toronto: King's Printer, 1938.)

Cyprus: Annual Report of the Inspector of Mines and Labour, 1937. By J. A. Bevan. Pp. 10, 13×8. (Nicosia: Government Printing Office, 1938.)

India: Annual Report of the Chief Inspector of Mines in India for the year ending December 31, 1937. Pp. 211, $9\frac{1}{2} \times 6\frac{1}{2}$. (Delhi: Manager of Publications, 1938.) Price Rs 2-2, or 3*s.* 6*d.*

Annual Review on the District Reports on the Working of the Indian Mines Act (IV of 1923) in the Central Provinces and Berar for the year ending December 31, 1937. Pp. 6, $9\frac{1}{2} \times 6\frac{1}{2}$. (Nagpur: Government Printing, 1938.) Price 5 annas.

The Mineral Production of India and Burma during 1937. By A. M. Heron. *Rec. Geol. Surv. India*, 1938, **73**, 303-397.

Queensland: Annual Report of the Under Secretary for Mines to the Hon. T. A. Foley, Secretary for Mines, including the Reports of the Wardens, Inspectors of Mines, Government Geologists and other Officers for the year 1937. Pp. 196, 13 × 8¼. (Brisbane: Government Printer, 1938.) Price 6*s*. 3*d*.

Western Australia: Report of the Department of Mines for the year 1937. Pp. 146, 13 × 8¼. (Perth: Government Printer, 1938.)

Western Australia: Annual Report of the Chemical Branch, Mines Department, for the year 1937. Pp. 12, 13 × 8¼. (Perth: Government Printer, 1938.)

South Australia: Annual Report of the Director of Mines and Government Geologist for 1937. Pp. 8, 13 × 8½. (Adelaide: Government Printer, 1938.)

South Australia: Mining Review No. 68 for the half-year ended June 30, 1938. Pp. 101, 9½ × 6. (Adelaide: Government Printer, 1938.)

Tasmania: Report of the Secretary for Mines for year ending December 31, 1937, with Reports of the Acting Government Geologist, Chemist and Assayer, Chief Inspectors of Mines, and the Mount Cameron Water-Race Board. Pp. 36, 13 × 8¼. (Hobart: Government Printer, 1938.)

Fiji: Annual Report of the Mining Board for 1937. *Council Pap. No.* 27. Pp. 11, 13 × 8. (Suva: Acting Government Printer, 1938.)

New Zealand: Report of the Geological Survey Branch for 1937-1938. *Dep. Sci. Industr. Res., N.Z.* Pp. 22, 13 × 8½. (Wellington: Government Printer, 1938.)

Statistique de l'Industrie Minérale et des Appareils à Vapeur en France, en Algérie, dans les Colonies, Pays de Protectorat et Territoires sous Mandat Français pour l'Année 1936. Deuxième Fascicule. *Ministère des Travaux Publics.* Pp. 124, 12 × 9. (Paris: Imprimerie Nationale, 1938.) Price frs. 70.

Das Bergwesen des Deutschen Reiches im Jahre 1937. *Z. Berg.-, Hütt- u. Salinenw. Dtsch. Reich*, 1938, **86**, No. 7, 215-280.

Holland: Jaarverslag van den Hoofdingenieur der Mijnen over het jaar 1937. Pp. 127, 9½ × 6½. (Hague: Algemeene Landsdrukkerij, 1938.)

Sweden: Bergshantering Berättelse för År 1937 av Kommerskollegium. *Sver. Offic. Stat., Industr. och Bergs.* Pp. 67, 9½ × 6½. (Stockholm: K. L. Beckmans Boktryckeri, 1938.)

Dutch East Indies: Jaarboek van het Mijnwezen in Nederlandsch-Indië, Vijf an Zesenzestigste jaargang 1936-1937. Algemeen Gedeelte. Pp. 334, 9½ × 6¾. (Batavia: Landsdrukkerij, 1938.)

MINING LAW

Coal Mines Legislation, Regulations and Orders, 1938, a Brief Review of Salient Features. By S. Walton-Brown. *Iron Coal Tr. Rev.*, 1939, **138**, 88-89, 97.

Southern Rhodesia: Amendment to Mining Regulations, 1935. *S. Rhod. Govt. Gaz.*, January 13, 1939, **17**, No. 2, 29.

Nova Scotia: An Act to Amend Chapter 22 of the Revised Statutes, 1923, "The Mines Act." Pp. 24, 9¾ × 6½. (Halifax: King's Printer, 1938.)

Nova Scotia: An Act to Amend Chapter 1 of the Acts of 1927, "The Coal Mines Regulation Act." Pp. 6, 9¾ × 6½. (Halifax: King's Printer, 1938.)

Nova Scotia: An Act to Amend Chapter 12 of the Acts of 1933, an Act for the Assisting of the Gold Mining Industry. Pp. 2, 9¾ × 6½. (Halifax: King's Printer, 1938.)

Manitoba: An Act to Amend "The Mines Act." Pp. 2, 9½ × 6½. (Winnipeg: Department of Mines and Natural Resources, 1938.)

Alberta: The Mineral Taxation Act, 1938. Pp. 4, 10 × 6½. (Edmonton: King's Printer, 1938.)

Alberta: The Mining Industry Wages Security Act. Pp. 5, 10 × 6½. (Edmonton: King's Printer, 1938.)

Alberta: The Coal Mines Regulation Act Amendment Act, 1938. Pp. 2, 10 × 6½. (Edmonton: King's Printer, 1938.)

Alberta: The Oil and Gas Conservation Act, 1938. Pp. 12, 10 × 6½. (Edmonton: King's Printer, 1938.)

British Columbia: Metalliferous Mines Regulation Act Amendment Act, 1937. Pp. 2, 10½ × 7¼. (Victoria: King's Printer, 1937.)

British Columbia: Placer Mining Act. Pp. 53, 10½ × 7¼. (Victoria: King's Printer, 1938.)

Government of Perlis: An Enactment to Amend the Mining Enactment, 1340. No. 1 of 1357. Pp. 8, 9½ × 6. (Perlis: Land Office, 1938.)

Government of Trengganu: Mining Enactment No. 51 of 1356. Pp. 23, 9¾ × 6. (Singapore: Malaya Publishing House, Ltd., 1938.)

Papua: An Ordinance to Consolidate and Amend the Laws relating to Mining. No. 1 of 1938. Pp. 83, 10 × 6. (Port Moresby: Government Printer, 1938.)

Papua: An Ordinance to regulate Prospecting and Mining for Petroleum. No. 13 of 1938. Pp. 28, 10 × 6½. (Port Moresby: Government Printer, 1938.)

Territory of New Guinea: The Mining Ordinance, 1928-1930, being the Mining Ordinance 1928 (No. 18 of 1928), as amended by the Mining Ordinance 1930 (No. 2 of 1930), and by the Mining Ordinance (No. 2) 1930 (No. 10 of 1930). Pp. 69, 9½ × 6. (Canberra: Government Printer, 1930.) Price 4*s.* 9*d.*

Territory of New Guinea: An Ordinance to regulate Prospecting and Mining for Petroleum. No. 43 of 1938. Pp. 25, 9 × 6. (Rabaul: Rabaul Printing Works, 1938.) Price 1*s.* 9*d.*

Contribution à une Étude Comparative des Législations Minières considérées dans leurs principes et leurs récentes évolutions. By H. Lantenois. *Ann. Min., Paris*, 1938, **13**, 321-411. Part III. Législation des mines en France et dans les pays relevant de l'autorité française.

Sudetendeutsches Bergrecht. By W. Schlüter. *Glückauf*, 1938, **74**, 960-966.

COMMERCIAL INTELLIGENCE

Statistical Year-book of the World Power Conference, No. 3. Data on Resources and Annual Statistics for 1935 and 1936. Edited by F. Brown. Pp. 138, 11 × 8½. (London: The Central Office, World Power Conference, 1938.) Price 20*s.*

The Mineral Industry, its Statistics, Technology, and Trade during 1937. Edited by G. A. Roush. Vol. 46. Pp. xviii + 778, 9 × 6. (London and New York: McGraw-Hill Book Co., Inc., 1938.)

South African Mining Year Book, 1938-1939. Pp. 392 + clxxxiv, 13¾ × 9½. (London and Johannesburg: S.A. Mining Journal Syndicate Ltd., 1938.) Price 21*s.*, London price 23*s.*

Industrial Minerals: A Quarterly Report showing Production, Local Sales, Exports and Names of Producers of Industrial Minerals for the Union of South Africa and the Territory of South-West Africa. *Quart. Inform. Circ., July-September* 1938, *Dep. Mines, Union S. Afr.* Pp. 34, 11 × 8½. (Pretoria: Government Printer, 1938.)

Report on the Miscellaneous Metals in Canada, 1937. *Min. Metall. Chem. Br., Canada*. Pp. 29, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1938.) Price 15 cents.

GEOLOGY AND MINERAL RESOURCES

Ore and Structure: The Dependence of Ore Shoots upon Structural Features. By J. Bichan. *Canad. Min. J.*, 1939, **60**, 14-16.

Field Determination of Rocks. By E. H. Davison. Pp. viii + 87, 8¾ × 5½. (London: Chapman & Hall, Ltd., 1938.) Price 7*s*. 6*d*.

Geology for Engineers. By R. F. Sorsbie. Pp. xxii + 348, 8½ × 5½. (London: G. Bell & Sons, Ltd., 1938.) Price 12*s*. 6*d*.

Base-Metal Mines of the British Isles. By S. D. Ware. *Min. Mag., Lond.*, 1938, **59**, 283-285. A review of conditions that have affected British metal mining in the past, and an expression of confidence in potential value under modern conditions.

Kenya: Geological Survey of No. 2 Mining Area, Kavirondo, Interim Report and Map of the South-West Quadrant. By W. Pulfrey. *Rep. No.* 7, *Min. Geol. Dep., Kenya*. Pp. 64, 9¾ × 6¼, and map. (Nairobi: Government Printer, 1938.) Price 2*s*.

Southern Rhodesia: The Geology of the Country around the Jumbo Mine, Mazoe District. By J. C. Ferguson and the late T. H. Wilson. *Geol. Surv. Bull. No.* 33, *S. Rhod.* Pp. 137, 9¾ × 6, and map. (Salisbury: Geological Survey Office, P.O. Box 366, 1938.) Price 4*s*. 6*d*.

Southern Rhodesia: The Geology of the Lower Umfuli Gold Belt, Hartley and Lomagundi Districts. By A. E. Phaup and F. O. S. Dobell. *Geol. Surv. Bull. No.* 34, *S. Rhod.* Pp. 150, 9½ × 6. (Salisbury: Geological Survey Office, P.O. Box 366, 1938.) Price 5*s*.

Tanganyika Territory: The Geology of the North Ilunga Area. By A. C. Skerl and F. Oates. *Short Pap. No.* 18, *Geol. Div., Dep. Lds. Mines*. Pp. 35, 10 × 7, and map. (Dar es Salaam: Government Printer, 1938.) Price 3*s*.

Tanganyika Territory: The Geology of Parts of the Tabora, Kigoma and Ufipa Districts, North-West Lake Rukwa. By G. M. Stockley. *Short Pap. No.* 20, *Geol. Div., Dep. Lds. Mines*. Pp. 35, 10 × 7, and map. (Dar es Salaam: Government Printer, 1938.) Price 3*s*. An account of the general and economic geology of the area.

Analyses of Rocks, Minerals, Ores, Coal, Soils and Waters from Southern Africa. Compiled by A. L. Hall. *Mem. No.* 32, *Geol. Surv., Dep. Mines, Union S. Afr.* Pp. 868, 9½ × 6. (Pretoria: Government Printer, 1938.) Price 15*s*.

Report on the Geology of the Superficial and Coastal Deposits of British Guiana. By D. R. Grantham and R. F. Noël-Paton. *Bull. No.* 11, *Geol. Surv. Brit. Guiana*. Pp. 122, 10 × 7½, and map. (Georgetown, Demerara: Government Printers, 1938.)

The Canadian Mineral Industry: Federal Government Activities. By E. J. Pryor. *Min. Mag., Lond.*, 1938, **59**, 265-277.

Quebec: Mining Properties and Development in the Rouyn-Bell River District during 1936. By L. V. Bell. *P.R. No.* 116, *Bur. Mines*. Pp. 83, 10¾ × 8½. (Quebec: Department of Mines and Fisheries, 1937.)

Simard (Expanse) Lake Map-Area, Témiscamingue County. By B.-T. Denis. *Ann. Rep. Quebec Bur. Mines for the calendar year* 1936. Part B, pp. 3-22, and map. (Quebec: King's Printer, 1937.) A report on the general and economic geology of the area.

Bruneau Township and Surrounding Area, Abitibi District. By G. V. Douglas. *Ann. Rep. Quebec Bur. Mines for the calendar year*

1936. Part B, pp. 37-59, and map. (Quebec: King's Printer, 1937.) A report on the general and economic geology of the area.

Suzor-Letondal Map-Area, Parts of the Counties of Laviolette, Saint-Maurice and Abitibi. By C. Faessler. *Ann. Rep. Quebec Bur. Mines for the calendar year* 1936. Part B, pp. 23-36, and map. (Quebec: King's Printer, 1937.) A report on the general and economic geology of the area.

Grevet (Kamshigama Lake) Map Area, Abitibi District. By W. W. Longley. *Ann. Rep. Quebec Bur. Mines for the calendar year* 1936. Part B, pp. 63-77, and map. (Quebec: King's Printer, 1937.) A report on the general and economic geology of the area.

Quebec: Mining Properties and Development Work in Abitibi and Chibougamau Regions during 1937. By S. H. Ross, B.-T. Denis, W. N. Asbury, W. W. Longley and P.-E. Auger. *P.R. No.* 120, *Bur. Mines.* Pp. 39, 10¾ × 8½. (Quebec: Department of Mines and Fisheries, 1938.)

Mining in Ontario. By T. W. Gibson. *Ont. Dep. Mines.* Pp. 180, 9½ × 6½. (Toronto: King's Printer, 1937.) A brief history of the mining industry of the Province of Ontario.

Index of Mining Properties in the Province of Ontario. Compiled by P. A. Jackson. *Bull. No.* 111, *Ont. Dep. Mines.* Pp. 38, 10 × 6½. (Toronto: King's Printer, 1937.)

The Mineral Resources of Manitoba. By G. E. Cole. Pp. 195, 11 × 8, and maps. (Winnipeg: Economic Survey Board, 1938.)

The Canadian Mineral Industry—The Provinces: (*b*) Alberta. By E. J. Pryor. *Min. Mag., Lond.*, 1939, **60**, 13-21.

The Canadian Mineral Industry—The Provinces: (*a*) British Columbia. By E. J. Pryor. *Min. Mag., Lond.*, 1938, **59**, 334-347.

Geology and Mineral Deposits of Freegold Mountain, Carmacks District, Yukon. By J. R. Johnston. *Geol. Surv. Mem. No.* 214, *Bur. Geol. Topogr., Mines Geol. Br., Canada Dep. Mines Res.* Pp. 21, 9¾ × 6½, and maps. (Ottawa: King's Printer, 1937.) Price 10 cents.

Laberge Map-Area, Yukon. By H. S. Bostock and E. J. Lees. *Geol. Surv. Mem. No.* 217, *Bur. Geol. Topogr., Mines Geol. Br., Canada Dep. Mines Res.* Pp. 32, 9¾ × 6½, and maps. (Ottawa: King's Printer, 1938.) Price 25 cents. A report on the general and economic geology of the area.

Some Observations on Structure at Gordon Lake, N.W.T. By C. Riley. *Canad. Min. J.*, 1938, **59**, 558-560.

The Geology of Parts of the Minbu and Thayetmyo Districts, Burma. By E. L. G. Glegg. *Mem. Geol. Surv. India*, 1938, **72**, Part 2, 137-317. A report on the general and economic geology of the area.

Contributions to the Mineralogy of Western Australia. Series XI. By E. S. Simpson. Pp. 16, 9½ × 6. (Perth: Government Printer, 1938.) Reprinted from the *Journal of the Royal Society of Western Australia*, 1937-38, **24**, 107-122.

Möglichkeiten der bergbaulichen Entwicklung Bulgariens. *Montan. Rdsch.*, 1939, **31**, No. 2, 37-38.

Erzbergbau und Hüttenindustrie der Tschechoslowakei. By W. Koch. *Metall u. Erz*, 1938, **35**, 547-552.

Zur Geschichte der Lobensteiner Erzgänge im Frankenwald. By W. Heyer. *Metall u. Erz*, 1939, **36**, 31-38.

Die Bodenschätze des Sudetenlandes. *Montan. Rdsch.*, 1938, **30**, No. 23, 2 pp.

Der Bergbau des Sudetenlandes. By F. Plasche. *Glückauf*, 1939, **75**, 37-46, 66-69.

Die bergwirtschaftliche Bedeutung Sudetendeutschlands. By M. Meisner. *Montan. Rdsch.*, 1938, **30**, No. 23, 1 p.

Die Mineralvorkommen der deutschen Schutzgebiete in Afrika und in der Südsee. By P. Range. *Z. prakt. Geol.*, 1938, **46**, 179-189.

U.S.S.R.: Mineral Deposits of the Southern Ukraine and of the Ural Mountains, as seen during the Excursions of the 17th International Geological Congress, 1937. By E. L. Bruce. *Canad. Min. Metall. Bull.*, 1938, No. 319, 505-523.

Rapporto sull'attività dell' Azienda Miniere Africa Orientale. *Industr. Min. Ital. Oltremare*, 1938-XVII, **12**, 490-498.

California: Mineral Industries Survey of the United States. Mines of the Southern Mother Lode Region. Part I. Calaveras County. By C. E. Julihn and F. W. Horton. *Bull. No.* 413, *U.S. Bur. Mines.* Pp. 140, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 30 cents.

Geology and Ore Deposits of the Lordsburg Mining District, New Mexico. By S. G. Lasky. *Geol. Surv. Bull. No.* 885, *U.S. Dep. Int.* Pp. 62, 9 × 6, and maps. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price $1.25.

Geology and Mineral Resources of the Honeybrook and Phoenixville Quadrangles, Pennsylvania. By F. Bascom and G. W. Stose. *Geol. Surv. Bull. No.* 891, *U.S. Dep. Int.* Pp. 145, 9 × 6, and maps. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 65 cents.

Peru: Labor del Departamento de Minería Aurífera. By J. F. Aguilar Revoredo. *Bol. No.* 121, *Cpo. Ing. Min., Lima.* Pp. 325, 9½ × 7. (Lima: Ministerio de Fomento, 1938.)

Geologie und Bodenschätze von Tannu-Tuwa (Urjanchai). By H. Hausen. *Z. prakt. Geol.*, 1938, **46**, 228-233.

PROSPECTING AND MINING METHODS

(*See also under Metals and Non-Metals.*)

Applied Geophysics in the Search for Minerals. By A. S. Eve and D. A. Keys. Third Edition. Pp. x + 316, 8½ × 5½. (Cambridge: The University Press, 1938.) Price 16*s*.

Geophysical Exploration by Spontaneous Polarisation Methods. By E. Poldini. *Min. Mag., Lond.*, 1938, **59**, 278-282, 347-352. A review of the phenomena of underground electrical polarisation and their application to the location of metalliferous ore-bodies.

Experiments in Geophysical Survey in New Zealand. By N. Modriniak and E. Marsden. *Geol. Mem. No.* 4, *Dep. Sci. Industr. Res. N.Z.* Pp. 92, 11 × 8½, and maps. (Wellington: Government Printer, 1938.) Price 7*s*. 6*d*.

Improvements in General Mining Practice. By C. B. Horwood. *Min. J.*, 1938, **203**, 991-992, 1013, 1034-1035, 1088-1089, 1094-1095, 1117-1119, 1136-1137, 1174-1175, 1186-1187, 1205-1207.

Notes on the Sinking of the Circular Ventilation Shaft, New State Areas, Ltd., Witwatersrand. By R. Daniel. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 412, 19 pp.

Dragline Dredges—a New Way to Mine Placer Gold. By C. W. Merrill. *Min. and Metall.*, 1938, **19**, 521-525.

Stemming in Metal Mines. By J. B. Richardson and J. D. Willson. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 412, 25 pp.

CONCENTRATION AND METALLURGY

(*See also under Metals and Non-Metals.*)

Metallurgical Developments at Mercur, Utah. By W. J. Franklin and V. Miller. *Tech. Pap. No.* 588, *U.S. Bur. Mines.* Pp. 42, 9 × 6.

(Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents. Data and general operating information on the treatment of gold-tailing dumps and ores in the Mercur (Utah) District.

Deep Air-Flotation at Britannia Mining and Smelting Company, B.C. By N. A. MacLeod. *Canad. Min. Metall. Bull.*, 1938, No. 320, 473-480.

Flotation Plant Practice. By P. Rabone. Third Edition. Revised and enlarged. Pp. xiii + 184, $8\frac{3}{4} \times 6$. (London: Mining Publications, Ltd., 1939.) Price 12*s.* 6*d.*

Principles of Flotation. By I. W. Wark. Pp. 346, 9×6. (Melbourne: Australasian Institute of Mining and Metallurgy (Inc.); London: The Technical Bookshop, 1938.) Price 21*s.*

Jigging, with Special Reference to the Moving-Sieve Buddle-Jig. By H. Hardy-Smith. *Proc. Austr. Inst. Min. Metall.*, 1937, No. 105, 1-52.

Water Supply in Bucket Dredging. By J. M. White. *Chem. Engng. Min. Rev.*, 1938, **30**, 476-478.

METALS

Aluminium and Bauxite

New and Growing Uses for Aluminium: Applications in Industry. By J. O. Chesley. *Metal Ind., Lond.*, 1938, **53**, 423-426.

Aluminium: Its History, Metallurgy, and Uses, with Projects for the School and Home Shop. By D. B. Hobbs. Pp. viii + 295, 9×6. (Milwaukee, Wisconsin: Bruce Publishing Co., 1938.) Price $3.

The French Aluminium Industry. *Light Metals*, 1938, **1**, 351-353.

Bauxite Deposits at Gánt, Hungary. By Q. D. Singewald. *Econ. Geol.*, 1938, **33**, 730-736.

Chromium

Chrome Mining at Selukwe, Southern Rhodesia. By J. Musgrave. *Bull. Instn. Min. Metall., Lond.*, 1938, No. 410, 16 pp.

Copper

Die Tsumeb-Grube im Otavi-Bergland (Deutsch-Südwestafrika). by F.-E. Klingner. *Z. prakt. Geol.*, 1938, **46**, 189-194.

The Nickel-Copper Mining, Smelting and Refining Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 12, $11 \times 8\frac{1}{2}$. (Ottawa: Department of Trade and Commerce, 1938.) Price 25 cents.

Air Conditioning for the Ventilation of Butte Mines. By A. S. Richardson. *Engng. Min. J.*, 1938, **139**, No. 10, 29-34. An account of the ventilating system installed by the Anaconda Copper Mining Company, Montana.

North O.K. Mine, Mungana District, Queensland. By C. C. Morton. *Queensland Govt. Min. J.*, 1938, **39**, 403-405. Geologist's report on copper prospects of the mine.

La Mine Prince Léopold à Kipushi. By G. van Esbroeck and M. van Weyenbergh. *Ann. Min. Belg.*, 1938, **39**, 253-269.

Leaching Copper from Worked-out Areas of the Ray Mines, Arizona. By R. W. Thomas. *Min. and Metall.*, 1938, **19**, 481-485.

Gold

World Gold Production Costs. By J. J. Croston. *Min. J.*, 1938, **203**, 1181-1185. Part III. Asia, Australia, New Zealand and the Pacific Islands.

Ore Concentration and Gold Milling: Progress recorded in Flotation

Machines and Reagents, By-Product Recovery, Alkalinity Control, Conveyors and Electric Ears. By E. W. Engelmann. *Min. and Metall.*, 1939, **20**, 13-16.

The Rietfontein (T.C.L.) Mine, Sabie. By W. P. Boxall. *J. Chem. Soc. S. Afr.*, 1938, **39**, 84-99.

Air Cooling in the Gold Mines on the Rand. By W. H. Carrier. *Canad. Min. J.*, 1938, **59**, 667-671.

Die Lebensdauer des Goldbergbaues am Witwatersrand (Südafrika). By R. Krahmann. *Montan. Rdsch.*, 1938, **30**, No. 21, 4 pp.

Mining Methods at Canadian Malartic Gold Mines, Ltd., Quebec. By E. V. Neelands and J. P. Millenbach. *Canad. Min. Metall. Bull.*, 1939, No. 321, 35-49.

Uchi-Slate Lakes Area, Ontario. By J. D. Bateman. *Canad. Min. J.*, 1938, **59**, 695-697. Preliminary report on the general geology and gold prospects of the area.

Mining and Milling at Dome, Hollinger and McIntyre. By J. D. Hall. *Canad. Min. Metall. Bull.*, 1938, No. 318, 469-486. A description of different gold mining methods in operation in Ontario.

Cut and Fill Mining at the Hollinger Gold Mine, Ontario. By A. N. Miller. *Canad. Min. J.*, 1938, **59**, 608-612, 681-691.

Rice Lake-Gold Lake Area, South-eastern Manitoba. By C. H. Stockwell. *Geol. Surv. Mem. No.* 210, *Bur. Geol. Topogr., Mines Geol. Br., Canada Dep. Mines Res.* Pp. 79, $9\frac{3}{4} \times 6\frac{1}{2}$, and maps. (Ottawa: King's Printer, 1938.) Price 25 cents.

Notes on Placer Mining in Alberta. By D. B. Rees. *Dep. Lands Mines.* Pp. 47, $8\frac{1}{2} \times 5\frac{1}{2}$. (Edmonton: King's Printer, 1938.)

The Polaris-Taku Mine, Tulsequah, B.C., the Geology and Development of a new Gold Property. By D. C. Sharpstone. *Canad. Min. Metall. Bull.*, 1938, No. 320, 481-500.

Crushing Plant at Pioneer Gold Mines of British Columbia, Ltd. By R. O. Udall. *Canad. Min. J.*, 1939, **60**, 5-13.

Development Costs at Goldfields, Lake Arthabaska, Saskatchewan. By J. C. Byrne. *Canad. Min. J.*, 1939, **60**, 23-25.

Refractory Ores of Eastern Victoria await Development. By G. B. O'Malley. *Chem. Engng. Min. Rev.*, 1938, **31**, 107-113. Need for examination of a neglected area with gold-arsenic-copper ores.

Excelsior and Ferneyside G.M.L's, Cracow. By A. K. Denmead. *Queensland Govt. Min. J.*, 1938, **39**, 263-265.

The Cracow Goldfield. By A. K. Denmead, with Appendix by C. L. Knight. *Queensland Govt. Min. J.*, 1938, **39**, 262-263, 335-340, 368-376, 406-412.

Garson's Gold Mines. By C. L. Knight. *Queensland Govt. Min. J.*, 1938, **39**, 301-302.

Washington Reef, Charters Towers, Queensland. By C. C. Morton. *Queensland Govt. Min. J.*, 1938, **39**, 332-334. Geologist's report on gold prospects of the area.

Black Jack Mine, Queensland. By C. C. Morton. *Queensland Govt. Min. J.*, 1938, **39**, 334. Geologist's report on gold prospects of the mine.

Mount Morgan Mine, Queensland. By S. R. L. Shepherd. *Queensland Govt. Min. J.*, 1938, **39**, 297-301.

Hayes Creek Goldfield, Cape York Peninsula. By S. R. L. Shepherd. *Queensland Govt. Min. J.*, 1938, **39**, 376-379.

Kalgoorlie Geology Re-interpreted, Western Australia. By J. K. Gustafson and F. S. Miller. *Proc. Austr. Inst. Min. Metall.*, 1937, No. 106, 93-125.

The Condition of Refractory Gold in Lake View and Star (Kalgoorlie) Ore, Western Australia. By N. I. Haszard. *Proc. Austr. Inst. Min. Metall.*, 1937, No. 108, 253-282.

Mine Sampling Methods and Records in Use at Triton Gold Mines, N.L., Western Australia. By G. A. Tanner and E. J. Sharpe. *Proc. Austr. Inst. Min. Metall.*, 1938, No. 109, 25-37.

Electrolytic Parting of Gold and Silver at the Works of the Broken Hill Associated Smelters Proprietary Limited, Port Pirie, South Australia. By F. A. Green. *Proc. Austr. Inst. Min. Metall.*, 1937, No. 107, 205-221.

Emperor Mine and Mill, Fiji. *Chem. Engng. Min. Rev.*, 1938, **31**, 55-67.

The Getchell Mine: New Gold Producer of Nevada. By R. A. Hardy. *Engng. Min. J.*, 1938, **139**, No. 11, 29-31.

Gold Mining in Costa Rica. By E. Bennett. *Engng Min. J.*, 1939, **140**, 56-58.

Goldvorkommen in der Mandschurei. By F. H. Stang. *Metall u. Erz*, 1938, **35**, 528-531.

Some Notes on Gold Mining Costs in the Philippines. By W. F. Boericke. *Canad. Min. J.*, 1938, **59**, 613-615.

The Geology of the I.X.L. Gold Mine, Masbate Island, Philippines, with Notes on its Equipment and Operation. By A. C. Skerl. *Bull. Instn. Min. Metall., Lond.*, 1938, No. 411, 23 pp.

Iron and Steel

The European Steel Cartel in 1938. *Iron Coal Tr. Rev.*, 1939, **138**, 115-117.

The British Iron and Steel Industry, 1938. *Iron Coal Tr. Rev.*, 1939, **138**, 101-102.

Steelworks Extensions and Developments in 1938. By W. J. Brooke. *Iron Coal Tr. Rev.*, 1939, **138**, 107-112.

Iron and Steel Imports and Exports in 1938. By S. Summers. *Iron Coal Tr. Rev.*, 1939, **138**, 102-104.

A Description of the Iron Ore Industry at Iron Knob and Whyalla. By R. T. Kleeman. *Proc. Austr. Inst. Min. Metall.*, 1937, No. 106, 53-92.

The Belgian Iron and Steel Industry, 1938. *Iron Coal Tr. Rev.*, 1939, **138**, 153-154.

The French Steel Industry in 1938. *Iron Coal Tr. Rev.*, 1939, **138**, 154-155, 157.

German Iron and Steel Industry in 1938. *Iron Coal Tr. Rev.*, 1939, **138**, 156-157.

Eisenerze und Hüttwesen der Ostmark. By R. Walzel. *Montan. Rdsch.*, 1938, **30**, No. 21, 1 p.

Zwiazek Polskich hut Żelaznych. Sprawozdanie z dzialalności wroku 1937 (istnienia Zwiazku osiemnastym). Pp. 76, $11\frac{3}{4} \times 8\frac{1}{4}$. (Warsaw: Plac Napoleona 9, 1938.)

Iron Ore in the Urals. *Metallurgia, Manchr.*, 1938, **19**, 33-34.

Iron Mining in the Urals. *Min. J.*, 1938, **203**, 1120.

The United States Iron and Steel Industry, 1938. *Iron Coal Tr. Rev.*, 1939, **138**, 151-152.

Open-Pit Transport on the Mesabi Range, Minnesota. By L. C. Moore. *Engng. Min. J.*, 1938, **139**, No. 10, 44-47, 55; No. 11, 52-54; No. 12, 50-52; 1939, **140**, No. 1, 49-53.

Truck Haulage on the Mesabi and Cuyuna Ranges. By R. W. Whitney and G. J. Holt. *Engng. Min. J.*, 1939, **140**, No. 1, 29-33.

Minerios de Ferro do Brasil. By M. G. de Oliveira Roxo. *Notas Prelim. Estudos No. 14, Serv. Geol. Mineral.* Pp. 16, 9 × 6. (Rio de Janeiro: Ministerio da Agricultura, 1937.)

Iron Deposit of Tayeh District, Hupei (Summary). By C. C. Sun. *Bull. Geol. Surv. China*, 1938, No. 31, 1-5.

Iron Deposit of Linghsiang, O'Cheng, Hupei (Summary). By C. C. Sun. *Bull. Geol. Surv. China*, 1938, No. 31, 7-9.

Lead and Zinc

The Zinc Industry at Avonmouth. *Min. J.*, 1938, **203**, 1157-1158.

The Origin of Primary Lead Ores: Paper II. By A. Holmes. *Econ. Geol.*, 1938, **33**, 829-867.

Blast Furnace Department at the Broken Hill Associated Smelters Proprietary Limited, Port Pirie, South Australia. By J. C. Hughes. *Proc. Austr. Inst. Min. Metall.*, 1937, No. 107, 157-187. A description of the lead smeltery practice.

Refining Processes at the Broken Hill Associated Smelters Proprietary Limited, Port Pirie, South Australia. By C. G. Pain. *Proc. Austr. Inst. Min. Metall.*, 1937, No. 107, 189-204.

The Dwight-Lloyd Blast Roasting Section for Sintering Lead Ores at the Broken Hill Associated Smelters Proprietary Limited, Port Pirie, South Australia. By P. J. Walsh. *Proc. Austr. Inst. Min. Metall.*, 1937, No. 107, 133-156.

Die Blei-Zinkerzlagerstätte von Römerstadt in Mähren. By K. Keilhack. *Z. prakt. Geol.*, 1938, **46**, 225-228.

Ein Beitrag zur Kenntnis der oberschlesischen Blei-Zinkerzlagerstätten. By A. Reimers. *Metall u. Erz*, 1939, **36**, 3-10.

Der heutige Stand der Aufbereitung der oberschlesischen Blei-Zink-Erze unter besonderer Berücksichtigung der Deutsch-Bleischarley-Erze. By H. Steck. *Metall u. Erz*, 1938, **35**, 617-620.

Die Zink-Bleierzvorkommen am Rauschen-Berg bei Traunstein. By K. Stier. *Metall u. Erz*, 1938, **35**, 591-594.

Manganese

Manganese in Brazil. *Miner. Tr. Notes*, 1938, **7**, No. 4, 12-19.

Mercury

Quecksilber: Geochemie, Lagerstättenübersicht und Produktionslage Grossdeutschlands und der Welt. By K. Richter. *Montan. Rdsch.*, 1939, **31**, No. 2, 33-36; No. 3, 57-62.

Nickel

The Nickel-Copper Mining, Smelting and Refining Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 12, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1938.) Price 25 cents.

Horizontal Cut-and-Fill Stoping at Falconbridge Nickel Mines, Limited. By E. B. Wright. *Canad. Min. Metall. Bull.*, 1938, No. 319, 542-551.

Platinum

Treating Precious Metal Speiss. By C. C. Downie. *Engng. Min. J.*, 1938, **139**, No. 10, 48-52. Some details of current practice in Great Britain for large-scale separation of metals of the platinum group.

Radium

Die sudetendeutsche Bergstadt St. Joachimsthal. By H. Schneiderhöhn. *Montan. Rdsch.*, 1938, **30**, No. 23, 3 pp.

Silver

Summary Review of the Silver Mining Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 29, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1938.) Price 25 cents. Including data on production of lead, zinc, arsenic and cobalt.

Electrolytic Parting of Gold and Silver at the Works of the Broken Hill Associated Smelters Proprietary Limited, Port Pirie, South Australia. By F. A. Green. *Proc. Austr. Inst. Min. Metall.*, 1937, No. 107, 205-221.

Desert Silver: Cyaniding 175 Tons Daily. By F. E. Gray. *Engng. Min. J.*, 1938, **139**, No. 10, 53-55. A description of the mining and ore treatment methods in operation at the Desert Silver Mine, Nevada.

Tantalum

Tantalum from the Black Hills, South Dakota. By A. I. Johnson. *Engng. Min. J.*, 1938, **139**, No. 11, 39-42.

Tin and Tungsten

The Tinplate Industry in 1938. *Iron Coal Tr. Rev.*, 1939, **138**, 119.

Über Zinn- und Wolframerz-Lagerstätten im Sudetengau. By O. Michler. *Montan. Rdsch.*, 1938, **30**, No. 23, 2 pp.

Tin Mining by Primitive Methods in Bolivia. By R. S. Handy. *Min. and Metall.*, 1938, **19**, 479-480.

Über die Zinnsteinlagerstätte Boneng in Indochina und ihre Nutzbarmachung. By K. Sallmann. *Metall u. Erz*, 1938, **35**, 645-651.

NON-METALS

Asbestos

The Asbestos Industry in Canada, 1937. I. The Asbestos Mining Industry. II. The Asbestos Products Industry. *Min. Metall. Chem. Br., Canada.* Pp. 13, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1938.) Price 15 cents.

Asbestos and Vermiculite Discovery in Montana. By C. C. Coulter. *Min. J.*, 1938, **203**, 1032-1033.

Chemical Products

Commercial Extraction of Bromine from Sea Water. By L. C. Stewart. *Canad. Min. Metall. Bull.*, 1938, No. 318, 443-447.

Clay

The Clay and Clay Products Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 25, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1939.) Price 15 cents. Including (1) domestic clays, (2) imported clays.

Coal, etc.

The World Coal-Mining Industry. Volume I. Economic Conditions. Pp. vii + 258, 9½ × 6¼. Volume II. Social Conditions. Pp. viii + 372, 9½ × 6¼. International Labour Office, Studies and Reports, Series B (Economic Conditions), No. 31. (Geneva: International Labour Office (League of Nations); London: P. S. King & Son, Ltd., 1938.) Price 8*s*. per volume.

Report of the Fuel Research Board for the year ended March 31, 1938, with Report of the Director of Fuel Research. *Dep. Sci. Industr. Res.* Pp. 255, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 4*s*.

Mechanisation in Coal Mines: A Survey of Progress in the Use of Mechanical Appliances in Coal-Getting and Underground Transport throughout the British Coal Industry, and particularly in the South Wales Coalfield. *Iron Coal Tr. Rev.*, 1938, **137**, 773-796.

Regulation in the British Coal-Mining Industry: Working of the Central Selling Schemes. *Iron Coal Tr. Rev.*, 1939, **138**, 86-88.

The British Coal Industry, 1938. By Sir R. A. Burrows. *Iron Coal Tr. Rev.*, 1939, **138**, 84-86.

Production and Distribution of Sized Coals. By Sir D. R. Llewellyn. *Iron Coal Tr. Rev.*, 1939, **138**, 90-92.

British Coal Export Trade in 1938. By R. Warham. *Iron Coal Tr. Rev.*, 1939, **138**, 92-93.

The French Coal Industry, 1938. By R. Fabre. *Iron Coal Tr. Rev.*, 1939, **138**, 147-148.

Die Steinkohle im deutschen Vierjahresplan. By B. Buskühl. *Montan. Rdsch.*, 1938, **30**, No. 22, 5 pp.

The Coal Industry in Germany, 1938. By H. Jahns. *Iron Coal Tr. Rev.*, 1939, **138**, 146.

Eine Übersicht über die Braunkohle-Produktiongesellschaften des Sudetenlandes. *Montan. Rdsch.*, 1938, **30**, No. 21, 4 pp.

Die Neuordnung der Kohlenwirtschaft im Sudetengebiet. By K. Uhlig. *Montan. Rdsch.*, 1938, **30**, No. 23, 2 pp.

The Polish Coal Industry, 1938. *Iron Coal Tr. Rev.*, 1939, **138**, 150-151.

The New Position of Polish Coal. By H. L. Brooks. *Colliery Guard.*, 1939, **158**, 59-63.

The United States Coal Industry, 1938. By J. R. Bradley. *Iron Coal Tr. Rev.*, 1939, **138**, 149-150.

Reisebericht über den Kohlen- und Erzbergbau der Vereinigten Staaten von Nordamerika mit besonderer Berücksichtigung der Rohstoffaufbereitung. By H. Schmitz. *Glückauf*, 1938, **74**, 997-1008, 1045-1056.

Carbonising Properties and Petrographic Composition of Upper Banner Bed Coal from Clinchfield No. 9 Mine, Dickenson County, Va., and of Indiana No. 4 Bed Coal from Saxton No. 1 Mine, Vigo County, Ind., and the effect of Blending these Coals with Beckley Bed Coal. By A. C. Fieldner, J. D. Davis, R. Thiessen, W. A. Selvig, D. A. Reynolds, R. E. Brewer and G. C. Sprunk. *Tech. Pap. No.* 584, *U.S. Bur. Mines.* Pp. 81, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Brazil: Composição Elementar e Immediata de alguns Combustiveis Nacionaes. By R. Roquette and S. Fróes Abreu. *Pub. Inst. Nac. Techn.* Pp. 21, 9 × 6¼. (Rio de Janeiro: Avenida Venezuela, 82, 1936.)

Geology of the Yangchiatun Coal Field, West of Peiping. By C. C. Wang and Y. Y. Lee. *Bull. Geol. Surv. China*, 1938, No. 31, 11-24.

Felspar

The Feldspar and Quartz Mining Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 12, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1939.) Price 10 cents.

Limestone and Dolomite

A Summary of the Uses of Limestone and Dolomite. By J. E. Lamar and H. B. Willman. *Rep. Invest. No.* 49, *State Geol. Surv. Illinois.* Pp. 50, 10 × 6¾. (Urbana: Department of Registration and Education, 1938.)

Magnesite

Magnesite in South Africa. By W. E. Sinclair. *Min. Mag., Lond.*, 1939, **60**, 9-12. A description of operating properties in the Eastern Transvaal, with some remarks regarding the possibility of industrial development.

Magnesite in Yugoslavia. By M. Kollibaš. *Min. J.*, 1938, **203**, 989-990.

Mica and Vermiculite

The Mica Industry: A Survey of the Production of Mica in the Principal Producing Countries, its Preparation, Fabrication, Uses and Distribution, with special reference to International Trade and Tariff Considerations. *Rep. No.* 130, *Second Series, U.S. Tariff Commission.* Pp. 155, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 25 cents.

Vermiculite Deposits in the Palaboroa Area, N.E. Transvaal. By C. M. Schwellnus. *Geol. Ser. Bull. No.* 11, *Dep. Mines S. Afr.* Pp. 27, 9½ × 6. (Pretoria: Government Printer, 1938.) Price 6*d*.

The Mica Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 12, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1939.) Price 10 cents.

Asbestos and Vermiculite Discovery in Montana. By C. C. Coulter. *Min. J.*, 1938, **203**, 1032-1033.

Petroleum, etc.

2me Congrès Mondial du Pétrole. Section I. Géologie, Géophysique, Forage. Tome I, pp. 1021, 11 × 8¾. (Paris: 85 Boulevard Montparnesse, 1937.) Price 36*s*.

The Petroleum Products Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 31, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1938.) Price 25 cents.

Alberta: Schedule of Wells drilled for Oil and Gas to 1938. Compiled by F. K. Beach. *Dep. Lands Mines.* Pp. 98, 10 × 6¾. (Edmonton: King's Printer, 1938.) Price $2.

Port Clinton Petroleum Prospects, Queensland. By J. H. Reid. *Queensland Govt. Min. J.*, 1938, **39**, 405.

Italian Hydrogenation and Oil Search. *Petrol. Times*, 1939, **41**, 18-19.

I Gas Naturali Italiani. *Industr. Min. Ital. Oltremare*, 1938-XVII, **12**, 508-512.

Die Krise der rumänischen Erdölindustrie. By O. Dünbier. *Glückauf*, 1939, **75**, 13-22.

Roumanian Oilfield Developments in 1938. *Petrol. Times*, 1939, **41**, 143-145.

Large-Scale Oil Search in Egypt. *Petrol. Times*, 1939, **41**, 44-47.

Search for Petroleum in Tunisia. By F. W. J. Saunders. *Petrol. Times*, 1938, **40**, 644-645.

Refractories

The Sources and Uses of Refractory Materials in the Metallurgical Industry. By C. C. Downie. *Min. J.*, 1938, **203**, 1053-1054, 1095-1096.

The Prospecting and Sampling of Undeveloped Fireclay Deposits. By C. R. Fettke. *Tech. Bull. No.* 73, *Amer. Refract. Inst.* Pp. 10, 9 × 6. (Pittsburgh, Pa.: Mellon Institute, 1938.)

Salt

The Salt Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 9, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1938.) Price 10 cents.

Production and Composition of Commercial Salt. By A. M. Wilson. *Serv. Bull. No. 7, Newfoundland Dep. Nat. Res.* Pp. 14, 9 × 6. (St. John's : Supplies Division, Department of Public Works, 1938.)

Sand and Gravel

Sand and Gravel Resources of Verchères, Saint-Hyacinthe, Bagot and adjacent Counties, with particular attention to Moulding Sand. By H. W. McGerrigle. *Ann. Rep. Quebec Bur. Mines for the calendar year* 1936. Part E, pp. 52, 9½ × 6½. (Quebec : King's Printer, 1937.)

Sulphur and Pyrites

New Applications of Sulphur. By W. W. Duecker. *Min. and Metall.*, 1938, **19**, 473-476.

The Pyrites Industry of Cyprus. By G. S. Duncan. *Min. J.*, 1938, **203**, 1116-1117.

L'Industria solfifera Italiana. *Industr. Min. Ital. Oltremare*, 1938-XVII, **12**, 499-507.

Talc

The Talc and Soapstone Industry (including Nepheline Syenite) in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 8, 11 × 8½. (Ottawa : Department of Trade and Commerce, 1939.) Price 10 cents.

Zircon

Zirconium and its Uses. By L. Sanderson. *Canad. Min. J.*, 1938, **59**, 692-693.

Miscellaneous

The Miscellaneous Non-Metallic Mineral Products Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 8, 11 × 8½. (Ottawa : Department of Trade and Commerce, 1938.) Price 10 cents.

Industrial Minerals and Rocks in British Columbia. By J. M. Cummings. *Canad. Min. Metall. Bull.*, 1938, No. 319, 552-566.

EXHIBITION GALLERIES, FILM LIBRARIES AND CINEMA

NOTES

Exhibition Galleries.—The Burma Government exhibit at the British Industries Fair held at Olympia and Earl's Court from February 20–March 3, 1939, was arranged by the Exhibition Galleries staff.

A large selection of photographs from the Galleries has been lent to the Colonial Empire Marketing Board for the purpose of making lantern slides to illustrate lectures on colonial products which have been prepared for educational purposes by the Board, also a further selection depicting life, scenery and industrial activities in the colonies for the preparation of enlargements for display in stillograph machines in the Board's exhibit at the forthcoming World's Fair in New York.

A story exhibit representing the Indian coffee industry has been assembled in the Indian Court. Starting with life-size models of coffee shoots in flower and in fruit, the story from the ripe coffee cherry to the peeled and graded bean is told in detail by means of enlarged coloured photographs and miniature models of the machinery employed. The course of the coffee cherry can be followed from the bush through the pulper into the fermenting and washing tanks and on to the drying floor. From here the parchment-coated beans are passed through the peeler to get rid of the coat and silver skin and after winnowing are finally sorted in the grader into different sizes of pea-berry and flat-berry. The photographs have been reproduced from originals supplied by the Indian Coffee Market Expansion Board and the models of machinery have been generously presented by Messrs John Gordon & Co.

To the Indian cotton exhibit has been added a modelled branch of an Indian cotton plant. This model represents one of the longer stapled strains with yellow flowers. Unripe green capsules are shown in the model and on the same plaque is exhibited a ripened boll from which a mass of white cotton has emerged.

A model of the ground-nut plant has been added to the Indian oil seeds exhibit. This model illustrates the type with trailing stems and shows the yellow pea-like flowers, the young green swelling fruits with lengthening stalks and below a representation of the soil line a number of the characteristic

fully-developed straw-coloured and wrinkled pods which have matured, as it were, below ground.

For the Aden Court a coloured and contoured map of the Aden Protectorate has been received from the Colony, together with a set of 12 photographs taken by the Royal Air Force. These are intended to form the beginning of a travelogue through the Protectorate starting at Perim in the west and finishing at Kishn in the east, the map being marked and numbered to correspond with the photographs.

Further exhibits for this Court have been received from Mukalla. These represent the Eastern Aden Protectorate and comprise samples of dragon's blood and honey, and of the local mat and basket weaving industry. Samples of dragon's blood have been received also from the Sultan of Socotra.

A new diorama, designed and constructed at the Imperial Institute studio by Mr. Herbert K. Rooke, has been completed and was first exhibited on the Mauritius Government Stand at the British Industries Fair before being installed in the Mauritius Court. The descriptive label attached to this diorama reads as follows:

Mauritius

Port Louis, Capital and Harbour

" Port Louis, the capital of Mauritius is situated picturesquely on the north-west coast and possesses a good harbour for ocean-going ships. In this diorama the view portrayed is of the port as seen from the deck of a steamer approaching the harbour.

" A channel through the fringing coral reef, made by the meeting of several rivers of the Island, affords a good approach, and the harbour has been dredged so as to provide berths for ten ships drawing from 24 to 31 ft. of water.

" The Moka mountains, a range of volcanic origin, are shown rising behind the town, two of the peaks, the Pouse, 2,661 ft. (right) and Pieter Both, 2,690 ft. (left) are used by day as landmarks to guide ships making for the harbour.

" On the north (left) the harbour is flanked by Fort George, a military post, while to the south (right) is the abandoned post of Fort William.

" In 1930 the Government built a deep-water quay 500 ft. long (centre) which is capable of handling 100,000 tons of cargo per annum. In the same year the granary alongside the quay was completed, having a storage capacity of 300,000 sacks of rice.

" The chief export from the Colony is sugar."

A new exhibit in the Southern Rhodesia Court, arranged with the co-operation of Messrs Bell's Asbestos and Engineering

Supplies, Ltd., illustrates the use of Southern Rhodesia asbestos for the manufacture of fire-fighting fabrics. The exhibit comprises three half-life-size figures clothed in asbestos suits illustrating the type used in the Royal Air Force and in Air Raid Precautions work; also curtains, rugs, blankets, gloves and upholstery work as used in the factory and in the home. Supplementing these exhibits are photographs showing how these articles and clothing are used in fire rescue work.

The Southern Rhodesia Court has also received from the Director of Native Education examples of school handicrafts employing sisal fibre as a medium for mats and baskets.

To the coffee exhibit in the East African Court, arranged under the caption, " From Seed-bed to Coffee Cup," have been added miniature models, one-twelfth actual size, of a coffee pulping machine and a Smout peeling machine kindly donated by Messrs John Gordon & Co. The Kenya Tea Growers' Association have kindly supplied for the same court three life-size models of tea sprays showing the method of plucking the leaf and the subsequent flush of young shoots that results from this operation.

The arrangement of the South African fruit models in three show cases against a scenic background, referred to on p. 504 of the last issue of this BULLETIN, has now been completed and is successful in conveying in a striking and attractive manner the idea of the variety and luxuriance of South African orchards.

At the close of the Empire Exhibition in Glasgow last year a selected number of exhibits from the very fine timber display in the West African Pavilion were, by arrangement with the Governments concerned, transferred to the Imperial Institute and have now been fitted into the West African Court in the north gallery.

The Nigerian exhibit comprises an office interior lined with veneers of golden walnut, agba, Nigerian pearwood, figured and striped sapele mahogany and obeche. The door is of sapele and the office equipment, comprising a desk, an armchair, book cabinets and overmantel, are of Nigerian pearwood, with a settee upholstered in Nigerian leather. Against the wall of the office is fixed a fan-cabinet fitted with swing panels of inlaid Nigerian woods, and on a double-slope stand are polished specimen planks of the following Nigerian timbers: obeche, golden walnut, agba, iroko, pearwood, sapele, opepe, mansonia, satinwood, Nigerian mahogany and camwood.

The Gold Coast exhibit consists of panelling and show-cases which have been fixed to the wall of the Court opposite the Nigerian display and occupy the side of one whole bay. The panelling comprises veneers of the following Gold Coast timbers: wawa, danta, kussia, makore, avodire, mansonia, guarea, dahoma, emri and denya. These have been prepared

from commercial average planks and are shown plain, wax-polished and cellulosed. The show-cases are of sapele mahogany veneer, lined with obeche. On a double-slope stand in front of the panels are displayed a collection of 4 ft. polished planks of Gold Coast timbers, the following kinds being additional to those already mentioned, namely obeche, sapele, opepe and idigbo.

The Sierra Leone exhibit comprises two handsome diorama cases of veneered sapele mahogany, also two wall-cases and a flat show-case in the same material and all of modern design.

The association of these exhibits in one bay in the North Gallery makes an imposing display and illustrates in a striking manner the resources of West African countries in handsome timbers suitable for all kinds of cabinet work.

A relief map showing the Islands of Malta and Gozo specially made at the request of the Malta Government by Col. F. H. Harvey has been added to the exhibits in the Malta Court, also a silk banner bearing the official Badge of Malta —a red and white shield with a gold border.

In the Bermuda Court has been arranged an excellent series of enlarged photographs of local life and scenery recently received from the Bermuda Tourist and Trade Development Board.

A bronze statuette of John Robert Godley has been added to the collection of Empire Builders and is exhibited in the New Zealand Court. This statuette has been cast from a sketch model of the original statue by Thomas Woolner, R.A., which is in Cathedral Square, Christchurch, New Zealand. The label inset on the plinth of the statuette reads as follows:

John Robert Godley

1814-1861

"John Robert Godley was born in 1814, the eldest son of John Godley, of Killegar, Co. Leitrim, Ireland. After being educated at Harrow and Christ Church, Oxford, he was called to the bar, but practised little, if at all. He travelled a great deal and was interested in colonisation.

"To relieve distress caused by the potato famine in Ireland he put forward a scheme by which a million souls would be emigrated to Canada, the cost to be found by Ireland, but this project was rejected by the Government of the time. In 1847 he stood for Parliament in the Tory interests but was unsuccessful.

"About this time he met Edward Gibbon Wakefield and accepted his theory of colonisation. This friendship led to the founding of Canterbury, New Zealand, on a plan drawn up

by Wakefield and Godley, the distinctive feature for which was the reservation of part of the proceeds of the sale of lands to meet the religious and educational wants of the community to be established.

"The state of Godley's health obliged him to leave England, so he sailed for New Zealand in December 1849. On arrival he administered the affairs of Canterbury during the critical early years of the settlement. His views of colonial management were 'I would rather be governed by a Nero on the spot than by a board of angels in London, because if the worst came to the worst we could cut off Nero's head, but we could not get at the board in London.' He left for England on December 22, 1852, and served in various posts in the Civil Service. He was a staunch advocate of colonial self-reliance in defence.

"He died at Gloucester Place, Portman Square, London, on November 17, 1861."

A pig of B.H.A.S. lead has been received from Austral Development, Limited, for inclusion in the Australian lead exhibit. The pig has been treated with cellulose varnish in order to retain as long as possible its bright appearance.

An addition to the Gilbert and Ellice Islands exhibit in the Western Pacific Court is a collection of examples of Ocean Island handicrafts presented by Mr. J. C. Barley, the British Resident. The collection comprises miniature model canoes, pandanus and coconut palm leaf manufactures in the form of a sleeping mat, fans, baskets and women's skirts, ceremonial swords of coconut-palm wood edged with shark's teeth, shell necklaces and fish hooks with line, a clam shell adze, and a wooden pestle and mortar.

The British Phosphate Commissioners have presented for use in this Court a map of the Pacific Ocean with insets in the margin which give the several island groups on a greatly increased scale.

Several new exhibits have been received from the British North Borneo Company and from the Bakau and Kenya Extract Company and placed on view in the North Borneo Court. These comprise pepper, copper, Manila hemp with photographs, and a collection of specimens illustrating the story of the mangrove cutch industry and the uses of mangrove extract in the treatment of sail cloth, cordage and fish netting.

A collection of new exhibits has been received from Sarawak and exhibited in the new Sarawak Court. These articles comprise additions to the cutch exhibit of a miniature bag and box of cutch extract to illustrate how the material is exported, photographs and samples illustrating stories of the pepper,

sago and gold mining industries, photographs of the petroleum industry and samples of copra, rubber, damar, jelutong, gutta percha, antimony ore and Sarawak timbers, and samples of handicrafts in the form of split and coloured rattan mat and basket weaving.

A new diorama illustrating the pepper industry in Sarawak, the work of Miss Jane Jackson, has been placed in the Court. The descriptive label reads as follows :

Sarawak

A Pepper Garden

" Pepper, in both black and white forms, has been exported from Sarawak in large quantities for many years. This diorama shows how the pepper plant is cultivated, how pepper is harvested and how the crop is prepared for the market.

" In the centre can be seen a nursery of young pepper plants about four months old which have been raised from cuttings, and on the extreme left are somewhat older plants that have been planted out and staked to allow the plants to climb. Mature plants about three years old, which have attained a height of about 12 ft., are being harvested, while in the background is a jungle clearing which will be planted to provide a succession crop.

" Bunches of unripe berries that fall prematurely are being gathered from plants on the right for the preparation of black pepper, whilst by means of ladders matured fruits are being hand-picked for the preparation of white pepper.

" In the forground a woman worker is occupied preparing black pepper by separating the berries from their stalks and exposing them on mats to dry in the sun. Further to the right a man can be seen steeping a sack of mature berries in a stream in the preparation of white pepper. This process, which is carried on over a period of 10 to 14 days, enables the skin to be easily washed off the pepper which is then dried white in the sun.

" In the right foreground is a heap of burnt earth under a thatched covering. The burnt earth has a red colour and is used as a fertiliser. It may be seen spread at the foot of the young pepper plants and on the soil of the mature plantation."

Empire and G.P.O. Film Libraries.—The use of cinematograph films, not only in schools but also by societies, travel associations and industrial organisations throughout the United Kingdom is growing rapidly and the Empire and G.P.O. Film Libraries are finding it increasingly difficult to meet the demands for films. Judging by the number of

applications received during January and February of the present year it would appear that the rate of increase recorded in the Director's Annual Report for 1938 is likely to be exceeded in 1939.

Many new films from home and overseas sources have been added to the Libraries. The list includes two of inter-Empire scope and the remainder have come from the United Kingdom (7), Eire (1), Canada (13), Australia (1), New Zealand (2), Union of South Africa (7), Southern Rhodesia (1), India (1), British East Africa (3), and the West Indies (4).

The first two are entitled " Oil from the Earth " and " Lubrication of the Petrol Engine " ; the one explaining the formation of oil-bearing strata, drilling, and pipe-line construction over desert country ; the other showing the effect of mechanical friction and motion in a modern motor car.

The United Kingdom films include " Southern Seaside," views of the south coast ; " When Day is Done," showing how the Miners' Welfare Fund has improved the social amenities of mining communities ; " This was England," a record of the continuous agricultural tradition in Suffolk from the stone age to the present day ; " Fruitlands," the orchards of Kent ; and " Wheatlands," the cornfields of East Anglia ; " New Worlds for Old " shows the latest scientific triumphs of the gas industry ; and " Plan for Living " is a cartoon film on food values that tells how to shop and cook.

The film from Eire, " Pleasure Island," covers many of the beauty spots of that country.

The latest Canadian additions cover a variety of subjects, including wheat cultivation, lumbering, the maple industry, fruit harvesting, salmon canning, scenic views, the harnessing of water power, and the growth and development of Vancouver.

" Big Timber " shows the ramifications of the timber industry in Australia. " Southward Ho " is a tour of South Island, New Zealand, and another film, " Our Daily Bread," deals with New Zealand agricultural life.

The Union of South Africa's latest contributions to the Library deal with developments in dairying, irrigation, forestry, maize and wheat, veterinary science, transport and wine production, and Southern Rhodesia's film, " The Consoling Weed," reproduces scenes in the growing, curing and marketing of tobacco, one of the Colony's most prosperous agricultural industries.

" Mother Ganges " is an Indian addition to the Library. It pictures life in the sacred city of Benares, and other scenes along the banks of the great river.

The happier side of life in Uganda, visits to tea estates in Kenya, and travel scenes in Kenya and Uganda are the themes of the three films from British East Africa. The titles of the

four from the West Indies, " Jamaican Harvest," " Tropical Lumbering," " Pleasure Trove in Trinidad," and " Petroleum in Trinidad " are self explanatory.

In addition to those mentioned above, twenty-two films dealing with the various activities of the G.P.O. have been added to the Libraries.

Cinema Hall.—As stated on p. 7, in addition to the film displays which are given daily, lectures are given from time to time in the Cinema Hall. These lectures, which are given by officials on leave from overseas and other lecturers who have personal experiences to relate of life in the Dominions and Colonies, are illustrated by lantern slides and films and are very popular with members of the general public as well as parties from schools. The following lectures have been arranged for the first quarter of 1939: " The Aborigines of Australia," Mrs. Helena Whitney Cass; " The Scenery of Uganda," Dr. A. W. Groves, of the Mineral Resources Department of the Institute; " Life in the Punjab," Dr. Rashid Ahmad, Headmaster of the Government High School, Ludhiana, Punjab; " The Pagan Tribes of Southern Sudan," Rev. C. E. Arnold; " Life in Uganda," Mr. W. B. Walker; and " The Story of Flight," Miss Peggy Salaman. Particulars of the lectures, as well as programmes of the film displays, which are changed weekly, are obtainable on application to the Assistant Secretary, Imperial Institute.

Colonial Visitors.—The following is a list of officers on home leave from the Colonies who have visited the Institute during the three months November 1938–January 1939:

NOVEMBER

D. A. BATES, Geologist, Gold Coast.
W. J. BLACKIE, Government Chemist, Fiji.
J. GORDON, Inspector of Plants and Produce, Department of Agriculture, Gold Coast.
J. INNES MILLER, Malayan Civil Service.
Lt.-Col. SIR BERNARD REILLY, K.C.M.G., C.I.E., O.B.E., Governor, Aden.
Dr. R. C. WILSON, Director, Geological Survey, Nigeria.

DECEMBER

J. C. BARLEY, British Resident, Ocean Island, Gilbert and Ellice Islands.
S. BRAY, Inspector of Mines, Northern Rhodesia.
N. CLARKE, Senior Veterinary Officer, Nigeria.
M. T. DAWE, O.B.E., late Director, Department of Agriculture and Forests, Palestine.
H. FRASER, Under-Secretary to Government, Federated Malay States.
Dr. F. J. MARTIN, Director of Agriculture, Sierra Leone.
H. R. MITCHELL, Senior Inspector of Mines, Nigeria.
R. S. PELLY, Assistant Conservator of Forests, Sierra Leone.
B. N. TEMPERLEY, Geological Survey, Tanganyika Territory.
E. J. WAYLAND, C.B.E., Director, Geological Survey, Uganda.

JANUARY

B. E. CARMAN, Superintendent of Education, British Honduras.
E. J. H. CORNER, Assistant Director of Gardens, Straits Settlements.
J. B. EDMONDS, Government Geologist, The Anglo-Egyptian Sudan.
K. HAMBOULLAS, Agricultural Department, Cyprus.
A. W. HART, Veterinary Officer, Nigeria.
E. PROCTER, M.C., Statistical Officer, Burma Railways.
M. L. WEBBER, Senior Assistant Conservator of Forests, Federated Malay States.

All Dominion and Colonial officers, as well as private residents overseas, who may be visiting London are cordially invited to come to the Institute to see our Exhibition Galleries, and to discuss scientific and technical problems in which they may be interested.

BULLETIN
OF THE IMPERIAL INSTITUTE

VOL. XXXVII. NO. 2. APRIL-JUNE, 1939

THE WORK OF THE IMPERIAL INSTITUTE FOR THE COLONIAL EMPIRE

By SIR HARRY LINDSAY, K.C.I.E., C.B.E.
Director of the Imperial Institute

FEW people perhaps realise the extent of our Colonial Empire or the vast possibilities for extended trade between our merchants and manufacturers at home and the producers and exporters of the various non-self-governing Colonies and their Dependencies, the Protectorates and the Mandated Territories. The Colonial Empire covers about 2¼ million sq. miles and supports some 60 million people, whilst the aggregate trade of the sixty or seventy administrative units comprising this Empire is nearly half that of the Dominions and India and about one-third that of the United Kingdom. What is being done to encourage the trade with this vast region and to develop its natural resources ? I propose here to say something of how the Imperial Institute is helping in this work, more particularly as regards its investigation and intelligence services. In addition, of course, there are our publicity activities by which we direct the attention of the British public to the life and work of the Colonies through our Exhibition Galleries, Cinema and Film Libraries.

The Colonial Empire, being less developed on the whole than the Dominions and India, naturally offers more scope for work such as that which we carry on at the Institute. Taking the work done for the Overseas Empire last year, six out of every seven of the laboratory investigations conducted in the

Plant and Animal Products Department emanated from the Colonies, whilst similarly four out of every five of the inquiries dealt with by the Intelligence Section of that Department were concerned with Colonial problems. On the mineral side the preponderance is not quite so marked, but even here 70 per cent. of the investigations and nearly 60 per cent. of the inquiries concerned the Colonies.

The materials submitted for examination consist in the main of (1) new or little-known products of which it is desired to ascertain possible uses and the prospects of marketing them in this country in competition with established articles of trade, or (2) the more usual commodities of commerce from new sources. The following examples taken from a report which I recently submitted to the Ceylon Government on the work conducted at the Imperial Institute for that Colony during 1938 will serve to illustrate the range of activities of our Plant and Animal Products Department.

The materials investigated included bread-fruit chips as a possible substitute for potato chips; kurakkan flour, the ground seeds of *Eleusine coracana*, as a feeding-stuff for livestock; the oil prepared from the shell of the cashew nut; annatto seed; papain; and the resin of the jak tree (*Artocarpus integrifolia*). A sample of turtle oil was also examined.

To illustrate the way in which the Department handles an investigation I will take in detail the case of the jak tree resin just mentioned. The latex of this tree is used in Ceylon as a "bird-lime" and a sample of the dried material was sent to the Institute in order to ascertain whether it could be employed in the European market. It was first examined chemically in the laboratory and was found to contain nearly 91 per cent. of material soluble in acetone, which after removal of the solvent proved to consist of a moderately hard, translucent, yellowish-brown resin. The material in its original state was then submitted to the Imperial Institute Consultative Committee on Gums and Resins and samples were examined by members of the Committee representing firms of gum and resin merchants. The general opinion was that it would be difficult to find an application for the dried latex in its crude state, but that it might be possible to prepare a useful product from it. These results were sufficiently promising to warrant more extended chemical investigation and trade

trials, and further material has now been obtained for these purposes.

The inquiries dealt with in the Intelligence Section likewise cover a very wide field and embrace every possible aspect of commercial commodities, including their sources, production, preparation, marketing, trade, and so on. The Ceylon report, referred to above, included the following subjects, among many others: the manufacture of slab tobacco, with details of the machinery used; the preparation and flavouring of milk drinks; the market for the dried calyces of *Hibiscus sabdariffa*, in demand in some countries as a tea substitute; the use of Ceylon-grown kapok for lifejackets; the marketing of poonac (coconut cake) and the qualities, grades, uses, etc., of the different coconut products prepared in Ceylon; sources of supply of *Trapa natans* nuts, used for making ornaments; cultivation of the tung tree and production of tung oil; the trade in papain and the preparation and packing of the material; and pyrethrum cultivation.

The activities of the Mineral Resources Department are likewise exceedingly varied, including as they do the identification and technical investigation of mineral raw materials and the answering of numerous trade and special inquiries, in addition to the publication work to which I will refer more specifically later. In all this work close liaison is maintained with the Colonial Geological Surveys and Mines Departments.

It is, of course, impossible in the short space here available to review adequately the diverse mineral inquiries and investigations emanating from the Colonies; yet some idea of their diversity may be gleaned if I mention just a few typical examples of those dealt with last year from the Gold Coast. An inquirer, for instance, who was interested in a manganese ore deposit in that country and desired general information on the subject was given the requisite data and shown relevant maps and documents in the Imperial Institute library. He was referred to our recently published monograph on "Manganese" and, for further details, to the Gold Coast Geological Survey. Other inquiries dealt with the domestic occurrences of bauxite, the utilisation of Nigerian lignite in the country, mining royalties and duties, and the production and exports of gold. In addition to the numerous mineral and rock identifications regularly carried out on behalf of the

Gold Coast Geological Survey, there have been important investigations involving mineralogical, petrological, chemical, mineragraphic and photomicrographic work on specimens presenting special problems of distinct economic importance associated with the mining of gold and manganese, the Colony's principal mineral exports.

Side by side with these activities of the Institute which relate to specific problems submitted to us from outside, we draw attention to the resources of the Colonial Empire in a more general way through the medium of our publications, which include our quarterly BULLETIN and numerous monographs on special subjects. As part of our services to the Colonial Governments we distribute the BULLETIN gratis to every administration and technical department overseas, in addition to copies subscribed for, whilst the monographs are sent to those departments specially concerned with the subjects dealt with. That the BULLETIN appears to be appreciated is shown by the fact that our list of regular subscribers (apart from the Government Departments mentioned) has grown substantially each year since 1936, when we started to publish it ourselves. The actual figures are: 1936, 330; 1937, 415; 1938, 529; 1939, 542. A new feature of the BULLETIN that we hope will prove of outstanding value to the Colonial Empire is the up-to-date information concerning the progress of geological and mining activity in the Colonies, based on particulars specially compiled for us by the Departments concerned.

As regards Monographs, in 1938 the Mineral Resources Department issued a comprehensive document on "Manganese" in which *inter alia* the manganese ore resources of the Gold Coast, Northern Rhodesia and British Malaya were fully described. The 1935-1937 edition of the Imperial Institute's "Statistical Summary of the Mineral Industry of the British Empire and Foreign Countries" was also published; this work, comprising 454 pages of detailed production and trade statistics of some fifty economic minerals, included data for the entire Colonial Empire.

PLANT AND ANIMAL PRODUCTS

REPORTS OF RECENT INVESTIGATIONS AT THE IMPERIAL INSTITUTE

Selected from the Reports made to the Dominion, Indian and Colonial Governments

NIGERIAN GINGER

THE production of ginger in Nigeria, which was started on a commercial scale about ten years ago as the outcome of the pioneer work carried out by the Department of Agriculture in that colony, has developed rapidly during this period, with the result that Nigerian ginger has won a place among the recognised grades of ginger on the world's market. Large quantities of this ginger were consumed in the United Kingdom up to 1936 and proved quite satisfactory, but certain lots from the 1935 and 1936 crops and the bulk of the consignments of the 1937 harvest, on being submitted to chemical examination, were found not to fulfil the requirements expected for peeled ginger, and in one or two cases legal proceedings followed.

The particulars in which these consignments failed were the percentages of water-soluble extractive and water-soluble ash, for which figures as low as 7·1 and 0·2 per cent. respectively were obtained. The figures used as the criterion of quality are the same as those laid down in the British Pharmacopoeia for peeled Jamaican ginger, viz. :

Alcohol-soluble extractive	Not less than 4·5 per cent.
Water-soluble extractive	Not less than 10·0 per cent.
(both expressed on the air-dried material) and	
Total ash	Not more than 6·0 per cent. and
Water-soluble ash	Not less than 1·7 per cent.
(both figures expressed on the material dried at 100° C.).	

On account of this failure to reach the desired standard and the fear of consequent prosecution, the market for Nigerian

ginger in the United Kingdom was seriously affected. The lack of demand caused large stocks of this ginger on hand in this country to remain unsold and severely restricted the importing of fresh supplies from Nigeria into the United Kingdom. Although the sale of Nigerian ginger to the Continent was not affected by the lower quality of the product, the difficulty experienced in disposing of supplies in the United Kingdom was of great concern to the authorities and producers in Nigeria. Accordingly, the Department of Agriculture in that colony in collaboration with the Imperial Institute undertook a series of tests to determine the cause of the deficiency in water-soluble constituents of recent crops, that is to say, to ascertain whether it was an inherent feature of the ginger now produced in Nigeria, or whether it was merely due to an unsuitable method of preparation of the ginger. The results of the investigation conducted at the Institute are contained in a paper by G. T. Bray, F. Major and E. L. Hill, published in *The Analyst*, 1939, **64**, 176-181, and are reproduced in the following pages.

Various views had previously been put forward to account for the deficiency in water-soluble constituents, but the opinion generally held was that in the preparation of the ginger the rhizomes had been soaked in water for too extended a period, the object of the prolonged immersion being to obtain a pale-coloured product, a pale colour being one of the desiderata of the trade. It was also suggested that the falling off in quality was due to soil exhaustion, but, although this may be true of the ginger produced by a few growers, the natives as a rule move their plantations after two or three years to fresh ground where the crop is often grown on virgin soil. This question, however, is being investigated by the Nigerian Department of Agriculture.[1]

For the purpose of the investigation a large batch of ginger rhizomes was obtained by the Department of Agriculture, Nigeria, and divided into smaller lots, and each lot was treated by one of the six methods (Trials 1, 2, 4, 6, 9 and 11) described

[1] Thirteen further samples of Nigerian ginger, prepared in different ways, have since been examined at the Institute, and the results afford no evidence that the ginger, whether cured or uncured, had suffered in quality through being grown on land on which this crop had been cultivated for three or four years. Several of the samples consisted of peeled ginger and they all complied with the requirements of the B.P. in respect of water-soluble extractive, alcohol-soluble extractive, total ash and water-soluble ash.

later. Samples of the products thus prepared (24 in all) were forwarded to the Imperial Institute, where they were submitted to chemical examination by the British Pharmacopoeia methods. The results obtained are recorded below.

Trial 1.—The rhizomes as harvested, after removal of the roots, were washed free from soil and dried in the sun.

The sample was examined with the following results:

Alcohol-soluble extractive.	Water-soluble extractive.	Total ash.	Water-soluble ash.
Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
6·4	16·3	7·7	5·8

Trial 2.—Dried peeled ginger was prepared from the rhizomes by the method previously advocated by the Department of Agriculture, which yielded a product of a quality hitherto freely accepted by the trade.

The rhizomes were freed from roots and washed free from soil on the same day as they were dug. The next morning they were scraped. While the scraping was in progress the unpeeled rhizomes were stored in water, and as each hand was peeled it was placed in clean water. When scraping was completed the ginger was washed[1] by gently rubbing and stirring it in six changes of water. As it was necessary to wash the ginger in batches, some of it was soaking[1] for a considerable time. The average time of soaking between scraping and washing was 1 hour. After being washed the ginger was spread on mat-covered platforms and turned three or four times a day until thoroughly dry.

The dried ginger was soaked for 10 minutes, washed once in water for 5 minutes, then spread out on platforms and dried. This process was repeated eight times, i.e. until the required colour was obtained. The products were sampled at the end of each stage of the process, and the samples were examined.

Sample 1 was of light greyish-brown colour and hard. The colour of the hands improved from sample to sample throughout the whole series, No. 10 being very pale buff. As the colour improved, so the ginger became less hard, the hands of Sample 10 being fairly soft.

[1] "Washing" means stirring and gently rubbing the ginger in water. "Soaking" is used to denote leaving the ginger undisturbed in water.

The samples were examined with the following results:

Sample No.		Alcohol-soluble extractive.	Water-soluble extractive.	Total ash.	Water-soluble ash.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
1	1st washing .	6·1	16·6	6·3	5·2
2	2nd ,, .	5·9	14·8	6·0	4·9
3	3rd ,, .	5·7	13·7	5·2	4·2
4	4th ,, .	5·8	13·2	5·3	4·2
5	5th ,, .	5·6	12·5	5·0	3·9
6	6th ,, .	5·6	12·5	4·4	3·2
7	7th ,, .	5·5	12·0	4·4	3·4
9	9th ,, .	5·4	11·8	4·1	3·2
10	10th ,, .	5·8	12·0	3·9	3·0

Trial 4.—In order to determine the effect of varying the period of soaking after scraping and prior to the first washing of the hands, separate batches of dried ginger were prepared by the same method as that used in Trial 2, i.e. by the Department of Agriculture method, but employing, instead of an initial soaking of 1 hour, a period of 2, 6, 12, 24, or 48 hours.

The five samples were examined with the following results:

Sample No.		Alcohol-soluble extractive.	Water-soluble extractive.	Total ash.	Water-soluble ash.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
4A	2 hrs. soaking	6·0	13·3	3·9	3·0
4B	6 hrs. ,,	6·0	12·9	4·3	3·3
4C	12 hrs. ,,	6·0	12·6	3·9	3·0
4D	24 hrs. ,,	5·9	12·8	4·2	3·2
4E	48 hrs. ,,	5·9	12·0	3·8	2·8

Trial 6.—*Native-prepared Ginger.*—In this experiment the method used to prepare the ginger exported early in 1937 and condemned by the market was followed as closely as possible. The ginger was washed in a basket immersed in a stream, the basket being lifted periodically to allow the water to drain and then re-immersed. After being scraped the ginger was washed for 8 minutes and then dried. It was soaked overnight for 13 hours 40 minutes and washed for 10 minutes; dried; soaked for 6 minutes; washed for 5 minutes; dried; soaked for 5 minutes; washed for 5 minutes; dried; washed for 5 minutes without previous soaking; dried; washed for 5 minutes; dried; washed for 5 minutes; dried. The total number of washings given was thus seven.

The ginger thus prepared was very similar in appearance to Sample 10 of Trial 2, being perhaps slightly better in colour. On examination it gave the following results:

Alcohol-soluble extractive.	Water-soluble extractive.	Total ash.	Water-soluble ash.
Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
5·4	8·4	2·4	1·6

Trial 9.—The ginger was prepared as in Trial 2, but the first washing consisted of three changes of water instead of six changes. The total number of washings was ten.

The resulting ginger was very similar in appearance to Sample 10, Trial 2. It gave the following results:

Alcohol-soluble extractive.	Water-soluble extractive.	Total ash.	Water-soluble ash.
Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
5·2	12·9	4·0	3·3

Trial 11.—The object of this trial was to determine the leaching effect of soaking the dried ginger overnight for 12 hours prior to each of the second and subsequent washings. Seven samples were prepared.

The seven samples were examined with the following results, which are shown in comparison with those obtained for corresponding samples in Trial 2:

Sample No.		Alcohol-soluble extractive.	Water-soluble extractive.	Total ash.	Water-soluble ash.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
2 (1)	1st washing .	6·1	16·6	6·3	5·2
11 (1)	2nd ,, .	5·2	10·2	3·4	2·5
2 (2)	2nd ,, .	5·9	14·8	6·0	4·9
11 (2)	3rd ,, .	4·7	7·7	2·3	1·2
2 (3)	3rd ,, .	5·7	13·7	5·2	4·2
11 (3)	4th ,, .	4·7	6·9	1·9	0·6
2 (4)	4th ,, .	5·8	13·2	5·3	4·2
11 (4)	5th ,, .	4·3	6·5	1·7	0·6
2 (5)	5th ,, .	5·6	12·5	5·0	3·9
11 (5)	6th ,, .	4·2	6·5	1·5	0·5
2 (6)	6th ,, .	5·6	12·5	4·4	3·2
11 (6)	7th ,, .	4·4	6·0	1·5	0·2
2 (7)	7th ,, .	5·5	12·0	4·4	3·4
11 (7)	8th ,, .	4·4	6·2	1·5	0·3
2 (8)	8th ,, .	(no sample received)			

The following comments may be made on the foregoing results:

Trial 1.—This unpeeled ginger is of satisfactory composition. Its figures meet the standard requirements, with the exception of the amount of total ash; in this connection it may be stated that the British Pharmacopoeia figures are intended to apply to *peeled* and not to *unpeeled* ginger.

Trial 2.—The results show that even after being washed and dried ten times the ginger produced still fulfils the requirements of the British Pharmacopoeia, provided that no prolonged soaking of the dried hands has taken place. It will

be noticed that the effect of successive washings is a distinct gradual lowering of the percentages of water-soluble extractive, total ash and water-soluble ash, while the effect on the alcohol-soluble extractive is only slight. The figures also indicate that the ginger does not suffer from any inherent deficiency of water-soluble constituents.

Trial 4.—This experiment shows that soaking the hands for periods up to 24 hours after scraping, and prior to their first washing, has no marked effect on the composition of the ginger. When the duration of the soaking was 48 hours a slight loss of water-soluble constituents took place, but the resulting product was still up to standard.

Trial 6.—The main differences in the methods of preparation of the native-produced ginger of Trial 6 and of Sample 7 of Trial 2 are that the former had prolonged immersion in a stream and a long soaking immediately prior to the second washing. The main differences in the preparation of this native-produced ginger and of Sample 1 of Trial 11 are that the former had a prolonged immersion in a stream and had been washed and dried five times more. Both Sample 7 of Trial 2 and Sample 1 of Trial 11 are up to standard, but the native-prepared ginger of Trial 6 is deficient in water-soluble constituents, and this deficiency would appear to be due to the ginger being kept in water too long.

Trial 9.—The results of this experiment show that reducing the number of changes of water used in the first washing has had the effect of slightly increasing the percentages of water-soluble constituents.

Trial 11.—The results of this trial indicate that soaking the dried ginger for long periods of time reduces very considerably the percentages of water-soluble constituents. The soaking for 12 hours prior to the second washing was sufficient to reduce the percentage of water-soluble extractive by 4·6 below the figure given by the corresponding sample in Trial 2 and the further soaking of 12 hours given prior to the third washing brought the product well below the standard.

The results of the investigation have shown that:

(1) There is no inherent deficiency of water-soluble constituents in Nigerian ginger as represented by the samples examined.

(2) A product of satisfactory quality can be readily prepared even when the ginger is washed and dried ten times, provided that excessive soaking of the dried, peeled ginger is avoided.

(3) The method of preparation advocated by the Department of Agriculture in Nigeria, which in the past has given a product acceptable to the trade, is satisfactory and can be recommended.

(4) The ginger can be stored in water, after being scraped and prior to being washed for the first time, for a period up to at least 48 hours without serious loss of water-soluble constituents.

(5) The method of preparation as used by the natives in 1937 is unsatisfactory and should not be employed, as the prolonged immersion of the *dried*, peeled ginger in water reduces considerably the percentage of water-soluble constituents.

(6) Reducing the number of changes of water in the first washing increases slightly the percentage of water-soluble constituents.

(7) Prolonged soaking of peeled ginger, once it has been dried, has a serious adverse effect on the percentage of water-soluble constituents and should therefore be avoided.

With a view to getting the producers to conform more closely to the recommended method of preparation, the Department of Agriculture have adopted a scheme of instruction and educational propaganda. Already improved results have been obtained, and ginger containing higher percentages of water-soluble constituents has been prepared by the native producers in Nigeria during the past year, but, although the content of water-soluble extractive has been raised to a satisfactory figure, there is still a strong tendency for the water-soluble ash percentage to be below the standard. Nevertheless, it is expected that before long the bulk of the Nigerian ginger prepared will fulfil the requirements of the consumers in the United Kingdom.

Summary.—The present investigation has provided abundant evidence that Nigerian ginger, if properly prepared for the market, conforms to the standards of the British Pharmacopoeia. It shows that the deficiencies in regard to water-soluble constituents, observed in certain samples during

1935-1937, are similar to those produced in these experiments by excessive soaking of the peeled ginger during preparation, and from the information received by the Imperial Institute regarding the manner in which the natives have been preparing the material there is no doubt that the deficiencies referred to are attributable to this cause.

ARTICLES

EXPERIMENTAL LEMONGRASS PLOTS IN AMANI

By R. R. Le G. Worsley, B.Sc., Ph.D., A.R.C.S.
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The lemongrass oil of commerce is derived mainly from *Cymbopogon flexuosus* Stapf and is largely East Indian in origin. *C. citratus* Stapf also yields lemongrass oil, but with slightly different characteristics; insolubility in 70 per cent. alcohol being the chief difference. This latter is the species in cultivation in East Africa. Preliminary work showed that *C. citratus* grew prolifically at Amani, could be cut about once a month, gave a good yield of oil and had a good citral content. I therefore had a plot of the grass planted out in 1934 for regular harvesting and distillation. This plot had an area of 1·2 acres, on a fairly steep slope of poor, well-drained soil, and the grass tufts were spaced 3 × 3 ft. Later, in 1936, another plot of 0·1 acres on level ground with fairly rich soil was planted with grass spaced only 9 × 9 in.

Ten cuttings in a year were obtained from each plot: the first plot was not cut initially until over a year old, when it yielded 7,000 kilos of grass, compared with the average monthly yield from later cuttings of about 600 kilos; this 7,000 kilos contained much dried-up material and the yield of oil was low. The second plot was first cut after six months, when a normal yield of grass was obtained, with a normal yield of oil.

The results are shown in Tables 1 and 2. Citral was determined by the bisulphite method; the rainfall figures give the actual rain which fell during the period from one cutting to the next, and are not the ordinary monthly records.

It will be seen that from both plots the yields of grass and of oil and the citral content all vary from month to month.

TABLE 1

1·2 acres of Lemongrass, spaced 3 ft. × 3 ft.; planted April 1934; first cutting July of following year.

Cutting.	Month.	Yield of Grass.		Yield of Oil.			Citral.	Rainfall.
		Weight.	Per Acre.	Weight.	Per Acre.	% of grass.		
		Kilos.	*Kilos.*	*Kilos.*	*Kilos.*		*Per cent.*	*In.*
1	July	7,000	5,830	9·50	7·92	0·136	79·5	—
2	Aug.	370	310	0·91	0·76	0·246	75·5	4·1
3	Sept.	900	750	2·17	1·81	0·241	76·0	2·2
4	Oct.	430	360	1·60	1·33	0·372	76·5	5·3
5	Nov.	640	530	2·24	1·87	0·351	75·0	1·1
6	Dec.	600	500	1·74	1·45	0·289	78·0	12·4
7	Jan.	595	500	2·40	2·00	0·403	76·0	0·1
8	Mar.	850	710	3·14	2·62	0·370	80·5	18·5
9	April	760	630	2·18	1·82	0·287	78·5	7·1
10	May	510	425	1·34	1·12	0·263	79·2	18·5
11	July	340	280	0·68	0·57	0·200	76·0	8·0
Total (excluding 1) .	.	5,995	4,995	18·40	15·35	0·307	Av. 77·3	77·3

TABLE 2

0·1 acres of Lemongrass, spaced 9 in. × 9 in.; first cutting after 6 months.

Cutting.	Month.	Yield of Grass.		Yield of Oil.			Citral.	Rainfall.
		Weight.	Per Acre.	Weight.	Per Acre.	% of grass.		
		Kilos.	*Kilos.*	*Kilos.*	*Kilos.*		*Per cent.*	*In.*
1	Mar.	830	8,300	1·62	16·2	0·196	77·4	—
2	April	830	8,300	1·76	17·6	0·212	77·5	13·7
3	May	460	4,600	0·96	9·6	0·208	78·9	21·9
4	July	320	3,200	0·64	6·4	0·198	77·1	12·6
5	Aug.	275	2,750	0·44	4·4	0·160	74·7	2·8
6	Sept.	370	3,700	0·60	6·0	0·163	77·8	13·1
7	Oct.	370	3,700	0·76	7·6	0·206	75·0	2·3
8	Nov.	460	4,600	0·98	9·8	0·213	75·0	3·6
9	Jan.	830	8,300	1·88	18·8	0·227	78·1	8·4
10	Feb.	550	5,500	1·21	12·1	0·209	74·9	1·9
Total		5,295	52,950	10·85	108·5	0·205	Av. 76·6	80·3

The closely spaced grass in plot 2 yielded, on the average, 10·6 times as much grass per acre as the widely spaced, but only 7·2 times as much oil, with a slightly lower citral content: the two experiments were, however, carried out in different years.

There does not appear to be any correlation between seasonal conditions and yields of grass or oil, but there seems to be one between the citral content of the oil and the rainfall during the growth of the grass. Fig. 1 shows the results when plotted, the figures for plot 1 showing better correlation than

those for plot 2: a straight line relationship is obtained, the citral content varying directly with the rainfall.

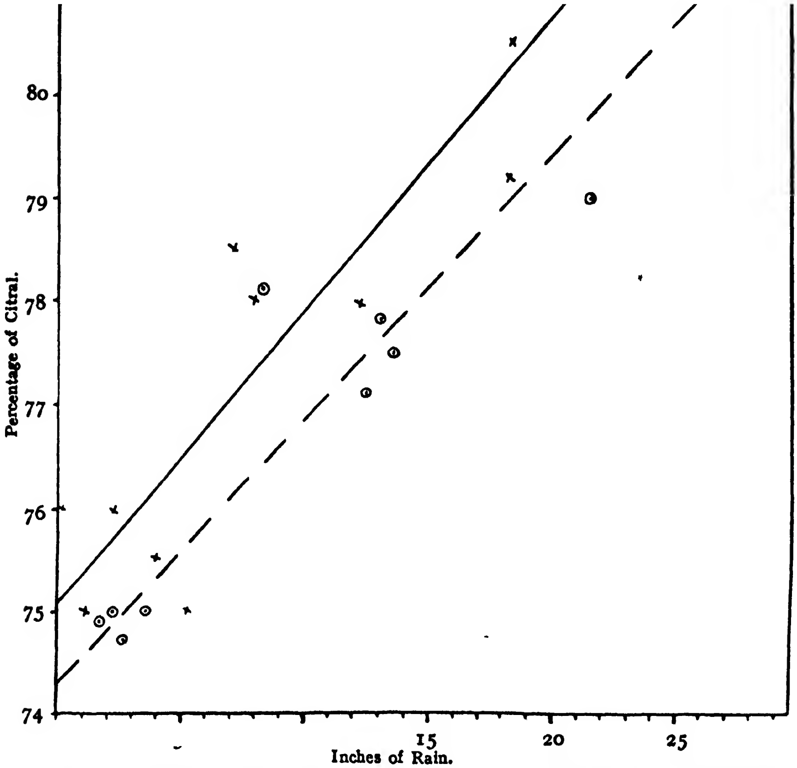

FIG. 1. SHOWING CORRELATION BETWEEN CITRAL CONTENT OF LEMONGRASS OIL AND RAINFALL DURING GROWTH OF GRASS. PLOT 1=X; PLOT 2=⊙.

The results show that close planting is, on the whole, advantageous. Amani is in the Usambara Mountains at an altitude of 3,000 ft.; I have no records for yields on the plains, but have been informed by one planter that he was able to cut the grass five or six times a year; the citral content of the few samples of oil from the plains that I have examined was high, one being 84 per cent.

Owing to the low prices generally prevailing for lemongrass oil, it is doubtful if it can be made an economic crop; as a supplementary crop it might possibly make a small profit.

A consignment of 90 lb. of the Amani oil was shipped to London, and after being held back for several months to find a favourable market, sold at 1s. 10*d*. a pound in February 1937, this being an unusually high value at that time.

THE WORLD'S CINCHONA BARK INDUSTRY—II

The Present Position of the Production of Cinchona Bark and Quinine in Empire Countries[1]

Countries within the Empire, other than India, where the prospects of cinchona cultivation seem to be promising are Tanganyika, the Cameroons under British Mandate and Malaya. A summary of the position in these and in other Empire countries where the tree has been introduced is given in the following paragraphs. In addition it may be mentioned that at one time cinchona bark was produced in Mauritius, Fiji and Jamaica, but the fall in price of quinine in the 80's killed the industry in these countries. The fact, however, that cinchona apparently succeeded there may be worth bearing in mind when considering possible countries for its cultivation. The climatic conditions in parts of British Guiana have also been regarded as suitable for the tree, but economic considerations would probably prevent the establishment of commercial cultivation in that region at the present time.

Tanganyika

In this Territory the conditions obtaining in the Usambara district appear to be particularly suitable for cinchona. Plantations were made there by the Germans 30 to 35 years ago on Bomolo Hill at what is now the East African Agricultural Research Station. The kinds planted include *C. ledgeriana*, *C. succirubra*, *C. robusta* and a hybrid (*C. ledgeriana* × *C. succirubra*). Small shipments of bark were sent to Germany in 1909 and 1912 and during the War the plantations were able to supply all the quinine needed by the German troops in East Africa and some was shipped also to Germany.

In 1918 samples of bark collected from the four types of tree at Amani were sent to the Imperial Institute for examination. That from the hybrid tree proved to be of specially good quality, giving a yield of 11·21 per cent. of quinine sulphate, showing it to be fully equal to the finest Ledger bark from Java (see this BULLETIN, 1918, **16**, 386).

Small consignments were subsequently sent to this country for sale and realised satisfactory prices.

[1] The position in India was dealt with in the previous part of this article (this BULLETIN, 1939, **37**, 29).

In addition to these German plantations an area of $5\frac{1}{2}$ acres was planted on the Drachenberg Plantation in the early twenties with Ledger and hybrid seedlings.

A full account of the history of cinchona at Amani, with a discussion as to the quality and yield of the bark from the different types of tree, will be found in an article by Dr. R. R. Le G. Worsley, published in this BULLETIN, 1935, **33**, 14-31.

Lately further development has taken place at Amani and the 38·4 acres under cinchona at Kwamkoro Estate were to be increased to 100 acres during 1938. It was proposed that this land should be planted with *C. ledgeriana* as far as seed is available and the remaining area with *C. succirubra* and a hybrid (*C. ledgeriana* × *C. succirubra*). It is hoped by this means to obtain still further evidence as to the commercial prospects of the crop in this region.

Cinchona is also to be found on certain private estates in Usambara. At Ngamba Estate, E. Usambara, there are about 75 acres, and at Balangai Estate, W. Usambara, about 50 acres. Both these areas were planted by the Germans and harvesting of the bark has taken place fairly regularly. Cinchona is also grown on Mazumbi Estate and at Lushote.

Cameroons under British Mandate

Cinchona plots were started by the Germans over 30 years ago on the Cameroon Mountain with seeds and seedlings from good-yielding Java trees. In 1924 the species then present, as determined by Kew, were *C.* near *micrantha*, *C. ledgeriana*, *C. succirubra* and *C. calisaya*. Four samples of bark collected from different plots, which were sent to the Imperial Institute for examination in 1918, proved to be of satisfactory quality for the manufacture of quinine, yielding from 6·7 to 8·2 per cent. of quinine sulphate (see this BULLETIN, 1920, **18**, 23).

Further trials have since been made by the Department of Agriculture. Seed of *C. ledgeriana* and *C. succirubra* from Java was sown by the Department of Agriculture in 1927 at the Botanic Gardens, Victoria, and the seedlings were planted out in 1929. The Ledger plants are reported not to have done so well as the *succirubra*, and it may be found necessary to graft that species on the latter under the conditions obtaining in the Cameroons. Further evidence seems desirable, however,

on this point, as the original Ledger plants are now probably over-mature and those planted in 1929 were put out in an open type of country without the support of forest which is so necessary to the successful growth of cinchona.

It is considered that there are large areas on the Cameroon Mountain which should be suitable for the cultivation of cinchona for totaquina production, but in spite of earlier results it seems doubtful whether satisfactory yields of quinine can be obtained in this region. In view of this and of the unconvincing results of trials with Indian-made totaquina carried out by the medical authorities in Nigeria, it is proposed to discontinue the experimental cultivation of cinchona in the Cameroons area.

Kenya

There is at present no direct evidence as to the suitability of Kenya for cinchona cultivation, but there may be areas in the Highlands where the tree will succeed. The question has been taken up by the Department of Agriculture and seedlings of *C. ledgeriana* and *C. succirubra* are being raised in Government nurseries for issue to planters in the Sotik and Kericho areas for trial and possibly also to natives elsewhere in humid areas.

New experimental plantings of Indian *ledgeriana* seed, obtained through Amani, have recently been started in the Nandi district and at Kakamega under the supervision of officers of the Agricultural Department in collaboration with the Forestry Department. The nurseries established at Sotik and Meru have proved too cold and exposed for rearing the young plants and have accordingly been given up.

Uganda

Cinchona is also the subject of trial in Uganda. A small plantation of *C. ledgeriana* was started by the Forest Department at their Arboretum at Entebbe in 1921. The growth was very satisfactory and in 1926 the bark was stripped from some of the trees. A sample of this bark examined at the Imperial Institute in 1927 gave a yield of 5·05 per cent. of quinine sulphate, which is quite satisfactory for five-year-old bark. More recent analyses are understood to have given a higher quinine content.

There are also experimental plantations of *ledgeriana* hybrids at various other places in Uganda at elevations ranging from 3,800 to 5,500 ft. A sample of hybrid bark grown at Bukalasa, also examined at the Imperial Institute in 1927, furnished 3·72 per cent. of quinine sulphate.

It may be mentioned that reports on the Uganda barks were published in this BULLETIN, 1928, **26**, 17, but at that time the exact botanical source of the material was not known and the Ledger bark was erroneously described as being derived from *C. succirubra* and the hybrid bark as *C. robusta* (?)

Nyasaland

Cinchona officinalis was grown at Chiringa, near Zomba, early in this century, but the area was planted up with Ceara rubber in 1907 and subsequently abandoned. In clearing the land in 1928 it was found that, in spite of neglect and overcrowding with other vegetation, some of the trees were still alive, which suggests that the conditions there are not unfavourable to cinchona. No development, however, seems to have taken place in this country.

Northern Rhodesia

A plantation of about 1,000 trees of cinchona is stated to have been established on Hill Wood Farm, Mwinilunga, in 1929. The trees apparently grew well, as some were reported later to be seeding, but no further information as to their progress or as to the species is available.

Burma

As a result of recommendations made by Colonel Gage in 1918, after his survey of the possibilities of development in India's production of quinine, plantations were started in the Tavoy District of Lower Burma, but in 1921 and 1922 these were practically destroyed by the heavy rains, and cultivation was transferred to the Mergui District. The plantations consisted mainly of *C. ledgeriana* as it was found at an early stage that *succirubra* did not thrive under Burma conditions.

For a few years the Mergui plantations made rapid progress and the outlook seemed promising, but it later became apparent that the site was by no means ideal for cinchona cultivation and that yields comparable with those obtained in Java could

never be expected. The difficulty of bringing the plants through the dry season from November to February, coupled with the damage done by the heavy rains in the monsoon presented a serious problem. Experimental cultivation in Upper Burma was advocated, but this plan never materialised.

From 1931-32 onwards there was no further extension or development of the plantations, operations being restricted to maintaining the existing areas in good condition. Production of bark was to be gradually reduced in accordance with the change in the Government's policy.

With the transference of the Mergui reserve to the Government of Burma in 1937 the plantations were closed down as the Burma authorities had no wish to continue operations. All mature bark was stripped off and sent to the Mungpoo factory, Bengal.

The quantity of bark handled in the years 1930-31-32 is given below in comparison with 1934-35-36 after the restriction scheme:

1930-31 . . .	131,533 lb.
1931-32 . . .	177,061 lb.
1934-35 . . .	64,429 lb.
1935-36 . . .	81,772 lb.

Ceylon

Cinchona cultivation in Ceylon was started in about 1860 and by 1875 the exports of the bark, largely obtained from *C. succirubra*, already amounted to nearly 19,000 lb. annually. The ruin of the coffee industry by leaf disease in 1880 resulted in a further increase in cinchona cultivation and by 1887 Ceylon had become the most important producing country in the world, exporting in that year over 13 million lb. of bark. Over-production followed, with a consequent fall in price of the bark, and cinchona cultivation was practically abandoned in favour of tea.

During recent years, however, the industry has to some extent been revived, but the original *C. succirubra* trees, many of which remain scattered about the plantations, yield bark with a low content of quinine. In 1927 the Department of Agriculture attempted to reintroduce *C. ledgeriana* but the trial proved a failure. Experiments are now being carried on with grafting and with the selection of high-yielding strains

for scions. Hybrids are also being cultivated experimentally and will be sampled when old enough. On the whole there seems little prospect of successfully developing areas of *C. ledgeriana* in Ceylon.

There is a small export of *succirubra* bark, the figures for the last three years being as follows: 1936, 140,448 lb.; 1937, 170,128 lb.; 1938, 155,904 lb.

Malaya

The first attempt to introduce cinchona into Malaya appears to have been made in 1878, but it was nôt long before the great fall in the price of quinine occurred and interest in the crop in the Straits then ceased. In 1915 further introductions of *C. ledgeriana* and *C. succirubra* took place, but in most cases the sites chosen for the plots did not meet the exacting requirements of the tree. Since then trials have been made in the Cameron Highlands with more promising results. Seed obtained from Java was sown at the end of 1926 and in the following year the first seedlings were planted out. Further sowings followed in 1927 and by the beginning of 1929 approximately 2½ acres each of *C. ledgeriana* and *C. succirubra* were planted out on jungle land which had been completely cleared, with an additional acre of each species in thinned out jungle still providing some shade. Three-year-old bark examined in 1930 gave the following satisfactory figures for alkaloid content, but was at the same time remarkably thin:

	C. ledgeriana.	C. succirubra.
	Per cent.	*Per cent.*
Total alkaloids . .	9·40	7·31
Quinine sulphate .	10·53	2·51

Subsequent analyses made in 1936 showed that although the figure for total alkaloids in the Ledger bark was practically the same, the content of quinine had fallen off. The average figure obtained, however, was still better than that for Indian bark, and in isolated trees the quinine content sometimes exceeded that normally found in Java bark.

In order to determine the most suitable site and type of plant a new series of experiments was commenced in 1936. Five plots of one acre each are being established in different parts of the Highlands and in each case *C. succirubra*, *C. ledgeriana* (both on its own roots and grafted on *C. succirubra*)

and *succirubra* × *ledgeriana* hybrid are being tried. During 1937 some thousands of plants of *C. ledgeriana* and *C. succirubra* were grown from seed for trials and transplanted to nursery beds, and in addition a number of self-sown hybrid seedlings were collected for nursery cultivation.

Although the soils in the Cameron Highlands are friable and the rainfall is adequate for cinchona and is evenly distributed, much of the land is on steep slopes and for plantations to succeed it will be necessary to select sites as free as possible from the dangers of erosion. Many of the conditions in this region are decidedly encouraging, but it is clear that much more experimental work remains to be done before the possibilities of large-scale planting can be definitely decided.

St. Helena

The introduction of cinchona to St. Helena dates from 1868. Seeds of *C. succirubra* and *C. officinalis* were sown in this year and by the end of 1869 a small plantation had been started in an area of partially cleared forest at about 2,000 ft. Although the trees made good growth the plantation was soon abandoned. It was stated in 1917 that the trees were then still in healthy condition after years of neglect and had reproduced naturally from seed. Samples of bark from both species were examined at the Imperial Institute in 1917 and gave yields of alkaloid which were higher than the average for *C. succirubra* and *C. officinalis* (see this BULLETIN, 1918, **16**, 383).

New Guinea

Although in Central New Guinea the soil, elevation, climate and rainfall conditions resemble very closely those of Java, the introduction of cinchona into this territory is only very recent. Seedlings have been reared successfully in the Ramu Valley and it was stated early last year that the Government Experimental Station had many hundreds of well-grown plants suitable for distribution. They are as yet too young for determinations of the quinine content.

THE POSITION IN FOREIGN COUNTRIFS[1]

Apart from the Netherlands East Indies cinchona has been introduced into a large number of foreign countries, but in

[1] The position in the Netherlands East Indies was dealt with in the previous part of this article (this BULLETIN, 1939, **37**, 25).

most of these cultivation is still in the experimental stage. In the French Colonies trials are being carried out in Réunion, Madagascar, the French Cameroons and Indo-China (where nearly 1¾ tons of quinine sulphate were produced in 1938), and much work is being done in the Belgian Congo. There is a small export of bark from the island of San Thomé. In the Far East plantations have been started in Formosa, whence the Japanese in time hope to obtain all their quinine requirements, and in the Philippine Islands, where totaquina has been prepared from locally grown bark. Attempts are also being made to establish the tree on plantation lines in Central America, especially in Guatemala. Other countries where trials are being made include Eritrea, Spain and the sub-tropical parts of the U.S.S.R. An outline of the developments in these countries and of the present position with regard to cinchona production is given in the ensuing paragraphs.

Belgian Congo

Although cinchona is said to have been grown in the Belgian Congo before 1890 extensive trials were not undertaken in the colony until 1901. Since that date there have been many introductions both of seeds and of young plants reared at the Jardin Colonial of Laeken in Belgium. It has been found that the plains of the Congo basin are too low-lying for satisfactory growth of cinchona, but promising results have been obtained from some of the hill stations on the eastern borders of the colony. In the Kivu district the Government experimental stations at Mulungu and Tshibinda, which are under the control of the Institut National pour l'Étude Agronomique du Congo Belge (INEAC), have considerable plantations of *ledgeriana*, *succirubra* and *robusta* at altitudes of 5,000 to 6,500 ft. These trees, which include some derived from seed of high-yielding strains obtained from Java, are giving satisfactory yields, and indeed some of the bark analyses show remarkably high contents of both quinine and other alkaloids.

In addition to the Government experiment stations, where selection work is being carried out, mention may be made of the Synkinac (Synquinak) Society's plantation at Kalonge, also in the Kivu district, which comprises about 80,000 trees, and that of the Fataki Mission in the Ituri district further

north with over 50,000 plants. Further extension of the area under cinchona is proposed, but the aim of all these enterprises is to supply quinine for consumption in the Congo rather than for export.

French Indo-China

Attempts to establish cinchona in French Indo-China have constantly met with such difficulties that although the earliest introduction dates from 1869 cultivation has still hardly progressed beyond the experimental stage.

The chief problems lie in the comparative scarcity of suitable soil and the lack of available planting space at sufficiently high altitudes, for under the conditions prevailing in the colony it does not appear possible to grow cinchona below about 3,500 ft. without heavy losses from collar rot disease.

The more recent trials commenced in 1917 with the opening by the Institut Pasteur of the Hon-Bà experimental station, which is situated on the Lang-Bian plateau in southern Annam at an altitude of about 4,900 ft. The soil in this locality is of granitic origin, rather shallow and poor in humus, and the young cinchona plants, some of which were grown from seed (*ledgeriana* and *succirubra*) and some from young grafts obtained from Java, did not survive long.

Further plantings in southern Annam were made by the same Institute in 1923 and 1924 at Dran (about 4,900 ft.) and and Djiring (3,200 ft.) in the Haut Donnai. These stations have a soil of basaltic origin, somewhat richer than that of Hon-Bà, but the climatic conditions are not very favourable, there being a dry season of about five months. Results were at first encouraging, but after three or four years the plants became unhealthy and weakened by disease and precocious flowering. Plants were reared from the seed of these trees, however, at Petit Langbian (5,200 ft.), where they made good growth and gave yields of from 8 to 12 per cent. of quinine sulphate at the age of seven years. Unfortunately there is no land available for extensive cultivation at this altitude and it has been necessary to concentrate attention on lower stations. The chief of these is at Diom (3,600 ft.) not far from Dran, which was planted with *ledgeriana* in 1932. Here the Institut Pasteur hope eventually to reach a maximum

annual production of 3,000 kilos of quinine sulphate for a period of ten years. The actual yields from loppings and thinnings in 1937 and 1938 were as follows:

	1937.	1938.
Bark . . *kilos* .	20,650	21,100
Quinine sulphate *kilos* .	1,434	1,793
,, ,, *per cent.* .	6·92	8·50

Cinchona has also been planted at experimental stations of the Institut des Recherches Agronomiques de l' Indochine. These are situated at Lang-hanh (3,300 ft.) and Blao (2,800 ft.) on the Haut Donnai plateau and at Paksong (3,600 ft.), further north on the Bolovens plateau.

Cameroons under French Mandate

The moist climate and volcanic soils of the mountains of the Cameroons seem to present conditions admirably suited to the growth of cinchona and very promising results have been obtained from trials carried out in the territory under French mandate.

Since 1922 numerous consignments of seed have been sent to the territory for planting at the Cinchona Station at Dschang, which is situated at an altitude of about 4,900 ft. Possibly owing to the poor quality of the seed received, these efforts met with no success during the first six years and it was not until 1928 that healthy seedlings were reared. Since then progress has been more satisfactory, and by 1937 there were a few dozen plants of *ledgeriana* making slow development and about 8,000 vigorous *succirubra* plants, the older trees being already up to about 25 ft. high. Analyses of the bark show a quinine sulphate content of 5 to 9 per cent. in the *ledgeriana* but only 1 per cent. in the *succirubra*, which, however, gave satisfactory yields (up to about 8 or 9 per cent.) of total alkaloids. Grafts of *ledgeriana* on *succirubra* stocks were started in 1935 and 1936, but at the time of writing the results of these experiments were not available.

The chief aim of the work, however, seems to be directed towards the growth of *succirubra* for totaquina production. An abundant supply of seed is now available from the plants introduced in the early stages of the work and 40,000 new *succirubra* plants have been put out since 1934 at various stations, some at considerably lower altitudes than Dschang,

as, for example, Yaounde (2,600 ft.), on the central plateau of the Cameroons. These new plantations are reported to be making very satisfactory progress.

Madagascar

Early attempts to establish cinchona in Madagascar were made from about 1896 to 1902 with the introduction of seed from Réunion and a number of young *ledgeriana* plants and grafts obtained from Java. Many of the plants died prematurely, but the experiments were abandoned before any decisive conclusions were reached. In 1914 analyses were made of the bark of some of the trees which still survived, but the yield of alkaloids was very poor.

Fresh trials with seed of *ledgeriana* and *succirubra* obtained from Java were started in 1928 at a station in the Forest of Ambre situated at about 3,300 ft. Conditions appeared fairly well suited to cinchona, and the trees made healthy growth, but analyses made in 1933 showed a very poor yield of quinine. The total alkaloid content was in some cases fairly satisfactory, but it can hardly be said that Madagascar appears promising as a future source.

Réunion

Early cultivation trials with cinchona in Réunion were carried out on a considerable scale. The first successful introduction was in 1886, and by 1894 there were said to be as many as 80,000 cinchona plants of various species on the island. Most of these were *succirubra*, which was found to grow well, particularly between the altitudes of about 1,600 and 3,300 ft. The yields of alkaloid obtained were unsatisfactory, however, and further trees reared from local seed, some of which was doubtless the result of free hybridisation, gave disappointing results. Interest in cinchona culture gradually waned, and many plantations were totally abandoned.

Since 1918 cultivation has been resumed and in 1935 from 1,500 to 2,000 trees were being exploited annually by the Grency Government Forestry Service. The whole of this supply of bark is being purchased by the Government Medical Service.

Eritrea

Cultivation of cinchona in Eritrea is still at an experimental stage. Plants of *ledgeriana* and *succirubra* have been reared

from seed introduced from Java in 1926, but so far the results indicate that the local conditions are more suitable to *succirubra* than *ledgeriana.*

Spain

It was reported in 1933 that cultural experiments with cinchona were to be made in Spain and the Canary Islands under the auspices of the National Institute of Forestry Research. Seed was obtained from Java, but there appears to be no further information regarding these trials.

Portuguese Colonies

Cinchona was early introduced into the Portuguese colonies of San Thomé, Principe, the Cape Verde Islands and Madeira, but although the trees appear to have grown reasonably well in the Cape Verde Islands it is only in San Thomé and Principe that cultivation was developed. The island of Timor has also been considered as a possible producer of cinchona, but there have been no serious attempts to introduce the crop there.

The first plants in San Thomé appear to have been reared from seed received in 1869, but most of the later plantations were derived from seeds and young plants sent from Lisbon from 1873 onwards. These originated from various sources, including Java and British India.

Cultivation developed steadily and by 1891 the annual production of bark in San Thomé and Principe amounted to nearly 110,000 lb. These islands have continued to produce cinchona, but the industry has suffered from the vicissitudes of the quinine market and in recent years there has been a considerable decrease in the output. Interest in cinchona is now reviving, however, owing to the unfavourable state of the market for cocoa, which is the principal export crop of the islands.

U.S.S.R.

Experimental work is being carried on in Transcaucasia with the object of developing a new method of cinchona production in which the entire plants are used for alkaloid extraction at the age of only one or two years. In this way it is hoped to overcome the difficulty of the rigorous winters of this region.

From the results of trials in which young plants were reported to contain about 1·4 per cent. of total alkaloids, it has been estimated that yields of 31 lb. of alkaloids per acre may be expected. There is no evidence so far, however, that the preparation of the alkaloids from these young plants will prove economical on a commercial scale. It is reported that large experimental plantations of *succirubra* have been laid out in the warmer regions of Georgia, but the results of this work are not yet to hand.

Philippine Islands

In the Philippines cinchona has been grown by the Forestry Department since 1927 for the preparation of totaquina for domestic consumption. Prior to this date there were a number of fruitless attempts to introduce the crop, but by the beginning of 1937 plantations occupying about 34 acres had been established at Bukidnon at an average altitude of 2,500 ft., with some 39,000 trees over two years old and 110,000 seedlings. A second area at an altitude of about 3,500 to 4,500 ft. was planted more recently and further extension is now planned. The trees consist of *ledgeriana, succirubra* and "hybrida" originating from Java seed. The yields of alkaloid have not been very high, but up to the beginning of 1937 a total of some 10 metric tons of bark had been harvested.

Lately there has been serious trouble in the plantations occasioned by disease which is thought to be due in part to unfavourable soil conditions. Planting at higher altitudes has been suggested as the plants appear to be more vigorous under such conditions and should therefore be less susceptible.

Formosa

Cinchona is grown in Formosa chiefly by commercial firms operating concessions on government lands. The plant was introduced from Java in 1919, but it is only during the last few years that the cultivation has received much attention. A greatly increased production is now planned and it is hoped that eventually Formosa will be able to supply all Japan's requirements of quinine.

The species introduced are *ledgeriana, succirubra* and "hybrida"; they appear to grow reasonably well under Formosan conditions at altitudes of between 2,000 and 3,000

ft., but have not so far given particularly high yields of quinine. No information is available as to the actual production in Formosa.

South American Countries

The eastern slopes of the Andes form the natural home of the cinchona tree, but there has been so much promiscuous destruction of the plants through wasteful methods of collecting the bark that in many regions the trees only survive in inaccessible forests. There appears to be no systematic cultivation of cinchona, and supplies of bark gathered from trees growing wild in the forests are gradually diminishing. Certain quantities are still exported from Equador (*succirubra*) and Peru.

Proposals to cultivate the trees have not materialised owing to lack of funds and difficulties of transport, but there has recently been established in Bolivia a government plant for the preparation of quinine from local bark. It is reported that the plant will produce considerable quantities of refined quinine for export and in order to ensure an adequate supply of raw material it is proposed to prohibit any further export of the bark.

It was reported in April 1939 that 1,000 seedling cinchona trees raised in the experimental gardens of the United States Department of Agriculture at Washington have been sent to Brazil for trial planting. The seedlings are stated to have stood the journey well and have survived transplanting. The results of this experiment will be watched with great interest.

Guatemala

Interest in cinchona cultivation has been revived during the last few years with a view to commercial production. Before extensive planting it is intended to make a careful choice of the localities most suitable for the growth of the crop, and to this end a number of small experimental plots are to be established under varying conditions of climate, altitude and soil. Seed is to be provided from old trees which originate from former abandoned plantations and have become naturalised in the country. A quinine content in the bark of more than 5 per cent. is looked for in trees to be used as a source of seed.

NOTES

Desiccated Coconut.—The principal countries producing desiccated coconut (D.C.N.) are Ceylon and the Philippines. Formerly Ceylon held a virtual monopoly, but aided by the American tariff and milling almost exclusively for the United States market, the Philippines is now the largest exporter. At one time much D.C.N. was manufactured by mills in the Eastern States of America with nuts imported from the West Indies and from Central America. The tariff made it profitable to remove such mills to the Philippines, and one mill at least was established in this territory by a Ceylon firm. Recent exports from the two countries were:

	Ceylon. *tons.*	Philippines. *tons.*
1936 . .	30,080	33,180
1937 . .	29,440	40,100

In 1938 Ceylon exported 28,693 tons, of which 16,527 tons were consigned to the United Kingdom, the remainder being distributed in much smaller quantities to a number of different countries.

A small D.C.N. industry has also been successfully initiated in New Guinea, with a production during the last two seasons of approximately 1,500 tons per annum, and this very largely supplies Australian requirements.

There are three kinds of D.C.N., and there is more than one grade of each. The following kinds and grades are recognised in the Philippines:

Grated—Fine, Medium and Coarse.
Shredded—Fine, Broken and Whole.
Ribbon—Broken and Whole.

Of the above "grated" is the common commercial kind of D.C.N., and the usual grades are fine and medium; these are very largely used in the grocery trade. The coarse grade is less important and is not always produced. Consignments of grated D.C.N. are usually sold on the basis of "half and half," i.e. a contract for 100 cases would comprise 50 cases of fine and 50 cases of medium.

"Shredded" and "Ribbon" D.C.N. are regarded as fancy cuts by the trade. These are used solely for confectionery, and are in much smaller demand.

Ideally, only carefully selected nuts should be used in the preparation of D.C.N., and these should not be husked and shelled before they are required in the mill. The important object in shelling is to remove the kernel unbroken, and this

is most readily accomplished when the nuts are fully ripe. According to information from one Philippine source, nuts are sometimes steamed after the husks are off to facilitate shelling without kernel breakage.

After shelling, the thin brown skin of the kernel may be pared off by hand with a special tool, i.e. a kind of spokeshave. Alternatively, a special coconut paring machine, recently evolved by a leading firm of manufacturers in the United Kingdom, may be used. Whichever method is employed, from 10 to 13 per cent. of the kernel meat is removed in addition to the skin, but the parings form a by-product from which coconut oil may be recovered.

The pared kernels must be transferred to washing troughs. These are tiled and contain clean water constantly replenished by means of inlets and outlets. During washing, inspection is made for blemishes, dirt or pieces of paring, all of which must be eliminated.

The whole kernels must also be cut into convenient sections, and in cutting, the milk of the kernels should not be permitted to mix with the water in the troughs, otherwise there is a risk of producing a rancid product. It appears that the actual time of cutting the kernels into sections may depend on whether machine or hand paring is adopted. With the machine it seems that cutting is done before paring, while with hand paring this operation may take place after a first washing.

From the troughs the kernel sections are taken in baskets, which permit rapid drainage, to the disintegrator or cutting machine. If grated D.C.N. is to be produced the meat is ground into meal in a disintegrator (sometimes called a grinding or grating machine) but for the shredded or ribbon products cutting machines are used.

In the production of grated D.C.N., coconut meal from the disintegrator is run into drying trays ; these may be 42 in. square and 2½ in. deep, and are fitted with perforated galvanised bottoms to permit drainage. Such trays hold from 20 to 25 lb. of wet coconut. The filled trays are at once transferred to the desiccator, where the contents are dried for about 45 mins. at a temperature of 180° to 200° F. When drying is completed the moisture content of the product should be 3 per cent. or slightly less.

After drying the coconut is sifted into the fine and medium grades, or into the fine, medium and coarse grades if all are produced. According to a recent account of the Philippine industry the fine grade is re-ground to form a fine flour.

The product is now cooled and packed. The cooling period is a matter for judgment, but the D.C.N. should be packed before it starts to reabsorb moisture from the air, i.e.

while the temperature is about 10° F. above that of the packing room. In packing the D.C.N. is pressed into boxes with a baling press; this provides an even packing density, and prevents the entry of air and moisture during transit. Standard cases are used. These may be of plywood, lead lined, with an inner lining of greaseproof paper. Various waterproof papers may also be utilised for the outer lining in place of lead.

Machinery for the Preparation of Tung Oil.—In a note on the preparation of Tung oil published in this BULLETIN, 1938, **36,** 357-360, a description was given of methods employed for decorticating Tung fruits and seeds and for expressing the oil. The methods generally entailed the use of decorticating and expelling machinery. Growers of Tung seed who may be contemplating mechanical decortication of their fruit or erecting crushing plant will be interested to know that suitable machinery for both purposes is manufactured in the United Kingdom. The firms concerned have given demonstrations of their plant before representatives of the Imperial Institute Sub-Committee on Tung Oil and the results indicated that the machines in question should prove quite satisfactory. Several decorticators of varying capacity are offered, namely, 12 in. hand-power model, dealing with 100-120 lb. of fruit per hour; 15 in. power-driven model with a capacity of 500-600 lb. of fruit per hour; 15 in. power-driven combined decorticator and separator of the same capacity; and 24 in. power-driven combined decorticator and separator capable of treating 14-15 cwts. of fruit per hour. The most suitable and economical expeller can deal with 5 cwts. of decorticated seed per hour and is designed to work in conjunction with the 24 in. combined decorticator and separator. For further particulars of these machines, their prices and the names of the makers, application should be addressed to the Director of the Imperial Institute.

Pulp Mills in New Zealand.—In an article on the Development of Empire Pulp and Paper Industries published in this BULLETIN, 1938, **36,** No. 2, brief reference was made to the position in New Zealand (p. 173). It was stated in connection with a new pulp and paper mill which was due to come into operation in 1938 that "To begin with the mill will draw its supply of raw material from indigenous woods supplemented by thinnings from plantations of introduced coniferous woods, chiefly *Pinus insignis*, grown under Government afforestation schemes." It was not intended by the latter statement to imply that the timber grown on State-owned forests would be used but rather that it would come from the privately-owned plantations which have sprung up as a result of the enlightened afforestation policy of the New Zealand Government.

The Director of Forestry, New Zealand, in a communication to the Imperial Institute, states that it is important that the forest policy of the present administration in respect of the exotic State Forests should be made quite clear and in order to avoid any possible misconception in this matter the following statement furnished by him is published.

"1. No private enterprise holds any present or future large-scale rights over the produce of New Zealand's exotic State Forests.

2. The policy that has always been adhered to in this respect is that all rights granted and sales made are :

(*a*) exercisable immediately and for a short term only ;

(*b*) subject to public competition over and above a stated upset price."

The Director of Forestry adds that in the case of the mill referred to above no rights at all have been either offered or granted.

RECENT RESEARCH ON EMPIRE PRODUCTS

A Record of Work conducted by Government Technical Departments Overseas

AGRICULTURE

Cover Crops

Centrosema pubescens

Malaya.—C. D. V. Georgi, Senior Chemist, in a report for the half-year July-December 1938, records analyses of *Centrosema pubescens.* This cover crop, which is said to be relished by cattle, was found to be rich in crude proteins compared with Guinea grass cut in the early stages of growth at three-weekly intervals. Figures for comparison are given in the following table :

	Centrosema pubescens. *Per cent.*	Guinea grass. *Per cent.*
Moisture	75·7	77·0
Crude proteins	5·4	3·4
Crude fat	0·7	0·2
Ash	2·3	4·3
Crude fibre	7·5	6·4
Nitrogen-free extract (by difference)	8·4	8·7
	100·0	100·0

Insecticides

Derris

Malaya.—T. D. Marsh, Acting Senior Agriculturist, in a report for the half-year July-December 1938, states that an experiment has been laid down to attempt to combine by hand cross-pollination the high toxicity of *Derris elliptica* var. Changi No. 3 with the high yield of *D. elliptica* var. Sarawak Creeping. The experiment will take several years to provide results as Derris is slow to flower. Encouragement is being given by allowing the plants to climb up 6 ft. supports.

Beverages

Cacao

Nigeria.—To the report of the Botanical Section, Southern Provinces, for the period July-December 1938, O. J. Voelcker has contributed a full account of the progress of cacao breeding work which is being carried out at Ibadan, INA and Owena. The following statement summarises the main points:

(*a*) Progeny trials at Ibadan have been established, and indications of the relative merits of the selected parents are coming to hand.

(*b*) Introductions of superior quality cacaos have been made and are now growing well.

(*c*) Duplicated progeny trials, combined with agricultural experiments, will shortly be bearing at INA and Owena.

(*d*) At all three stations the cacao leaves much to be desired in uniformity, due first and foremost to soil variations and, secondly, to unsound technical management with its corollary of heavy annual supplying.

H. C. Doyne, Senior Agricultural Chemist, Southern Provinces, in his report for the half-year July-December 1938, states that in conjunction with the Botanical Section at Ibadan the butter fat content of red and yellow pod types of Forastero cacao grown from selected trees on Moor Plantation has been determined regularly from January 1936 to August 1938.

The results expressed as percentages of butter fat in moisture-free nib show that:

(*a*) There is no difference between the red and yellow pod types.

(*b*) There is a significant difference between fermented and unfermented cacao amounting to about 1·5 per cent. in favour of the former.

(*c*) There is a significant seasonal variation, the average figures for cacao harvested between August and January (the main crop) being 5 per cent. more than for that harvested

between February and July (the light crop). Extreme differences of over 10 per cent. were obtained during these periods. (See also *Trop. Agric., Trin.*, 1939, **16**, 76.)

Coffee

Uganda.—The Kampala Plantation is being closed down and the work on coffee breeding is being transferred to the new experiment station at Kawanda. An experiment on Robusta coffee at the Plantation, started in 1933, by which different soil treatments were given to four small adjacent plots, has been ended and the following statement regarding the experiment is contained in A. S. Thomas's report on the work of the Plantation for the half-year July to December 1938.

The treatments were :

(*a*) Clean weeding, without any cultivation, all weeds being removed by hand.

(*b*) Elephant grass mulch.

(*c*) Weeds slashed, which soon leads to a dense growth of grasses over the soil.

(*d*) Cover of *Centrosema pubescens*, a low growing evergreen legume.

The effect of these treatments on the growth of the coffee plants has been most interesting—those under mulch (*b*) are the best, but the clean plot (*a*) is nearly as good. The permanent cover crop plot (*d*) in the rainy seasons looks fairly well but in dry spells it suffers ; while the slashed plot (*c*) is very bad—the bushes consist of upright stems bearing only a few short primary branches at the top, with yellow leaves and scarcely any fruit.

During October the distribution of roots in the different plots was examined ; by means of a soil auger samples were taken from the soil at various distances from the bushes and at various depths below the surface. In general, the amount of roots present in a plot is proportional to the vigour of the plants above ground, and the differences between the plots are even more marked in the case of roots than in respect to stem growth. The surface rooting character of Robusta coffee is well shown—most of the fine feeding roots are in the top 6 in. of soil, while in the case of the plot under *Centrosema* many of the coffee roots are above the ground among the stems and rotting leaves of the cover crop.

At the same time similar samples were taken from a plot of Arabica coffee near by and the differences between the root habits of the two species were strikingly demonstrated—the roots of Arabica coffee in the top layer of soil were much less than those of Robusta coffee in the same position.

Tea

Malaya.—A. Thomson, Senior Plant Pathologist, in a report for the half-year July-December 1938, states that a survey of root diseases in lowland and highland tea showed that red-root disease caused by *Ganoderma pseudoferreum* is the most prevalent disease in the low country tea estates, and that *Ustulina zonata* is the next most important root disease fungus. The latter fungus was, however, more prevalent on highland tea areas where also brown-root disease was fairly common. It was definitely established by inducing the formation of fructifications and by study of isolations in pure culture that *Fomes noxius* is the cause of brown-root disease of tea.

Uganda.—A. S. Thomas, in his report on the Kampala Plantation for the half-year July to December 1938, points out that the poor germination of some batches of local tea seed has been a distinct problem in Uganda and therefore germination tests have been carried out on batches of seed picked up at weekly intervals from beneath the seed-producing trees of Dahootea jat on the Kampala Plantation. This investigation has been carried out over two years—from June 1936 to May 1938 inclusive—and the final counts of germinated seed were made before the end of 1938 (the germination may be spread over a time of some months). It is now obvious that the moisture relations of the seed are the controlling factors in its capacity for germination—the seed picked up after wet spells has grown much better than that picked up after dry weather. In Nyasaland it has been found that, on account of the drying out of the seed, it is better to pick the fruits when they are ripe and to allow them to open in the shade before extracting the seed rather than to allow the fruit to open on the trees and to gather the seed from the ground. The same procedure is advisable in the drier parts of Uganda if a high germination of tea seed is to be secured; the first supplies of Kampala seed, picked up from the ground and planted at the end of 1936, germinated badly at Kawanda; but seed from fruits gathered from the trees and sown in May 1938 has grown very well.

Cereals

Maize

Nigeria.—F. D. Golding, Senior Entomologist, in a report covering the work carried out in 1938, records the following results of an experiment in the storage of maize.

Early in March, 14 bushels of weevilled shelled maize were fumigated with carbon bisulphide and placed in a large cylindrical metal bin. There was no lid available so the grain

was covered with an old tarpaulin on which was scattered 1½ lb. of flaked naphthalene. A further layer of old tarpaulins was placed on top and the whole covered with dry river sand to a depth of 4 in. The bin was opened about four months later and the grain was found to be free from weevils and in the same condition as in March. The bin was standing in a store containing infested maize. The grain was utilised for feeding cattle, which ate it readily. The method is of use in localities where airtight containers are unobtainable.

Rice

Malaya.—According to the report of T. A. Buckley, Acting Senior Chemist (Soils), for the half-year July-December 1938, the investigations into the alleged deleterious effect of slime or silt from tin dredges in irrigation water for rice were continued. A repetition of experiments in pots did not confirm the previous finding that the presence of slime was beneficial. The condition of the plants was actually inferior to that of the controls although the average yield of grain was about the same. A field experiment was instituted on an area of 9 acres, in which the sub-plots were irrigated with fresh water or water containing various concentrations of slime derived from a ditch line from a tin-dredge in the vicinity. The experiment is still in progress but has not revealed any definitely harmful effect of the slime as yet.

It seems possible that mining slime is initially beneficial, but eventually deleterious as alleged.

G. H. Corbett, Senior Entomologist, in his report for the same period, states that a considerable amount of research work is in progress on padi-borers, mostly *Diatræa polychrysa* Meyr., and it is hoped to publish the results of certain investigations in the near future. It has previously been recorded as a result of four years' continous work that fluctuations in egg-masses and in yields occurred, and that in the months when the yields were poor, egg-masses were numerous, but that a correlation between total bored stems and yields had not been found. Preliminary statistical analysis, however, indicates that :

(*a*) There is a high positive correlation between yield and surviving tillers produced in the first three months.

(*b*) There is no correlation between yield and surviving tillers produced in the fourth and subsequent months.

(*c*) There is, for individual tanks, a high positive correlation between numbers of egg-masses found in the first sixteen weeks and numbers of 1-3 month tillers killed by borers.

(*d*) There is, for individual tanks, a fairly high negative

correlation between yield and egg-masses found in the first sixteen weeks.

These conclusions are given tentatively and are subject to further checking of the analyses but they suggest that if rice were cultivated so that its growth occurred during the months when egg-masses were less numerous, surviving tillers of the first three months would be greater, resulting in higher yields. Unfortunately, the drier months of the year coincide with those when egg-masses are less numerous.

The answer as to whether padi plants can be kept free from borers by the collection of egg-masses appears to be "No." The results from the experiment in which padi plants were grown in enclosed cages show that when 45-day-old padi is exposed to borers for one month the yield is considerably greater than that from 45-day-old padi exposed for two and for three months, but that the difference in yield between padi exposed for two and three months is not significant and indicates that the percentage of bored tillers in the padi exposed for two and three months is of the same order.

Root Crops

Cassava

Nigeria.—In previous Bulletins (1935, **33**, 68; 1936, **34**, 510) reference has been made to investigations concerning the production of cassava varieties which will prove immune or at least highly resistant to the mosaic disease in this country. In the report of the Botanical Section, Southern Provinces, for the half-year July-December 1938, J. West gives the following further information on this subject.

The disease appears to be more virulent and to spread more rapidly in the coastal areas. Since Ibadan is nearly 100 miles inland, the main field tests of new varieties are carried out, in co-operation with the Agricultural Officer at Agege, about 20 miles from the coast. Material now undergoing trial at Agege consists of 20 hybrid strains derived from local and introduced varieties and 12 hybrid strains supplied by the Gold Coast Department of Agriculture in the later part of 1937.

The local hybrid strains appear to possess a very high degree of resistance since most of them have shown no sign of infection during a period of at least three years. Mr. A. V. Gibberd, Agricultural Officer, Agege, gives the following yields for some of the most promising hybrid strains during 1938, when grown in one of the main rotations on the farm:

Selection.	Yield per Acre (Estimated).
CH28	9·0 tons
CH128	10·6 ,,
CH61	9·7 ,,
CH50	11·3 ,,
Local variety	7·2 ,,

He addes that the tubers were readily disposed of in the local market and that cuttings are now being distributed for more extended trials at Agege and at Abeokuta.

Spices

Nutmeg

Malaya.—A. Thompson, Senior Plant Pathologist, in a report for the half-year July-December 1938, states that a disease of nutmeg fruits characterised by the development of brown lesions on the exterior of the skin, splitting and premature falling, was reported from two localities to have destroyed about 50 per cent. of the crop. The fungus associated with the trouble was *Coryneum myristicæ*, well known in Java in connection with a similar disease.

Oil Seeds

Coconuts

Malaya.—The following statement relating to copra drying is taken from a report of F. C. Cooke, Chemist, Coconut Products, for the half-year July-December 1938.

The small inexpensive copra kilns constructed of wood and attap and designed on a new principle, which were originally evolved in 1936, effected a remarkable reduction in the time required to dry copra and produced an exceptionally smooth, clean and even white product. Investigations have been carried out recently to determine the reason for their inability to maintain the high level of their initial performances and for small irregular variations in the moisture content of the derived product. It has been discovered that the decline in the working efficiency after the first month of operation was due to the sealing of the attap roofs owing to drying out and settlement. Otherwise the efficiency and speed of production depend firstly on the character of the coconuts under treatment, secondly on the weather conditions and thirdly on the time and method of operation. These factors affect the working of all copra kilns, but with the new cabinets the effect is emphasised because of their small size.

The cabinets now under construction will incorporate a jack-roof since, in spite of a slight extra cost, it has been found that this materially improves the performance and makes it easily possible to obtain crisp dry copra with a low consumption of shell fuel. Consequently external factors need not prevent a satisfactory performance as the fuel supply will be ample to meet all circumstances. The slight increase in cost is compensated for by the increased load it has been found possible to treat owing to the improved ventilation.

Oil Palm

Malaya.—T. D. Marsh, Acting Senior Agriculturist, in a report for the half-year July-December 1938, states that experiments on the germination of oil palm seeds showed that no benefit was obtained by first soaking the seed in running water for varying periods up to 37 days. Fresh seed planted in sand gave a germination of 80 per cent. in six months. The rate of germination was not increased by planting seed in beds of pericarp refuse.

According to the report of T. A. Buckley, Acting Senior Chemist (Soils), for the same period, investigations have continued into causes of and remedies for the premature dying of oil palm leaves leading to stunting and reduction of yield, a condition becoming increasingly prevalent. It is likely that different causes may be operating in different areas. Analysis of leaf material suggested a shortage of calcium and magnesium, but a common feature of soils of affected areas appears to be deficiency of available potash and magnesium. Arsenic in the soil has been found associated with the trouble but not proved to be responsible. Soil acidity may be occasionally, but not necessarily, injurious. Manurial programmes and experiments with soil covers are still in progress in various places.

Nigeria.—The following statements by F. W. Toovey on oil palm investigations are taken from the report of the Botanical Section, Southern Provinces, for the half-year July to December 1938.

The Selection Programme.—During 1938 a further 56 acres of selected oil palms were planted at Ogba Farm, Benin. Of this area, 50 acres were planted at treble the normal density, so that the total number of palms planted last year was nearly 9,000. In the densely planted area the palms were set out at one-third the normal spacing in the rows (the rows being east to west to give the minimum shading), but the distance between the rows was unchanged. With normal planting at 29 ft. triangular this treble density gives, theoretically, 179 stands (approximately) to the acre. The seedlings planted in this area are all the progeny of thin-shelled trees and, as they will not come true to type, it is intended that off-type palms shall be cut out when the trees come into bearing so that the plot will be reduced, finally, to the normal density, although the "stand" may be irregular. This method of establishing selection plots has been used at the experiment station at Yangambi in the Belgian Congo, and it has the merit that the available land is used more economically, since palms which are not likely to be of use in the selection programme are eliminated at an early age.

The 50 acres of thin-shelled selections planted in 1938 formed an extension of the two ten-acre seed plots planted at Ogba Farm in 1935 and 1937 and which have been previously mentioned in these reports. An area of 70 acres of selected palms, isolated in forest, is thus now available for the supply of seed for extension work.

The seedlings planted in 1938 were mainly the progeny of selected trees at N'dian (" Lisombe ") and Aba. Some unselected Lisombe material was also planted. The 6 acres not included in the extension to the seed plots were planted with seedlings from a cross between two outstanding trees in the Aba selection plots, one being a thick-shelled tree which has yielded over a period of 6 years at the rate of a ton of oil per acre (assuming only 12 per cent. extraction) and the other a thin-shelled tree of good fruit type and fair yield. It is hoped that this cross may give rise to some interesting progeny.

As indicated previously (this BULLETIN, 1938, **36**, 238) efforts have been made to widen the basis of oil palm selection in Nigeria. An attempt is being made to exploit all the natural resources of the country for valuable oil palm material, and introductions of promising strains from other oil palm growing countries are also contemplated. It is felt that only by examining the whole range of material available in the world can any important progress in selection and breeding be made. This has certainly been the experience with other crops and, in fact, many of the spectacular successes obtained by breeding might be largely ascribed to this method.

Fortunately there appears to be no lack of promising material in Nigeria. Although the search for outstanding palms has not as yet gone very far, palms of exceptionally high yield have already been discovered at Aba, and palms with promising fruit types have been found in the Umunebo-Ufuma area.

As a further policy of extending the field of selection, the United Africa Company has very kindly undertaken the yield recording of 100 acres of palms on their estate at N'dian. This recording was commenced at the beginning of 1938.

The main policy of planting for selection during the next few years seems likely to be the concentration in one place of a mass of material produced from the primary selection areas such as Aba, Umunebo-Ufuma and N'dian. The bulk of the planting to date has been done on the departmental farm at Benin, although small selection plots have also been established at other stations. The palms planted consist of the progenies of Calabar and Aba selections ; Lisombe types and a few Deli introductions have also been established. The approximate acreage and number of stands planted to date is as follows :

Calabar progenies . .	4,982 stands	79·5 acres
Lisombe progenies . .	6,290 ,,	45·7 ,,
Aba progenies . . .	3,666 ,,	31·2 ,,
Deli progenies . . .	102 ,,	2·0 ,,
Total	15,040 stands	158·4 acres

Thus there are now available in Nigeria over 15,000 useful palms, most of which are the progenies of trees which have passed a preliminary selection test for yield or fruit type. These palms will be used for further selection and for the supply of selected seed for distribution to native farmers. As new selection areas are exploited, the area of useful palms will be increased by planting controlled pollinated seed obtained from them.

To extend the facilities for oil palm research in Nigeria a scheme for an Oil Palm Research Station has been drawn up, and the preliminary proposals have been approved by Government. A site of 4,000 acres has already been provisionally selected for this station, and this area should provide ample land for the planting of selection plots and for the carrying out of cultural experiments.

Sterility in Oil Palms.—A problem, whose seriousness was not at first realised, has now become apparent and is introducing complications into the selection programme. This problem concerns the occurrence of so-called " sterile " palms in the progeny of certain selections. The term " sterile " does not, unfortunately, give a true picture of the phenomenon, but as it has now crept into the literature it seems advisable to adhere to it.

Among the range of fruit types in the oil palm there is one which has long been recognised and has been given the varietal name *pisifera*. This type is characterised by the absence of shell in the fruit, and often the kernel is absent as well. It would appear that the *pisifera* type may be considered as occupying the extreme end of the range of fruit in the oil palms. This range extends from the thick-shelled type through intermediate forms to the thin-shelled or *tenera*. The *pisifera* type appears, therefore, to be the next step in this series and to come after the *tenera* type. In actual fact, however, there does not appear to be a critically sharp distinction between *tenera* and *pisifera* palms, and intermediate types are suspected to occur.

The *pisifera* or " shell-less " type is, however, sufficiently well defined for practical purposes.

The most important characteristic of *pisifera* palms is that the fruit bunches on them rot off before maturity. The fruits appear to develop normally up to a certain point and then abort. Usually this happens to all the bunches on the palm

with the result that no fruit is set on such palms, and hence they are known as "sterile." Occasionally some of the fruit bunches on a *pisifera* palm are carried through to maturity, and still more rarely such palms appear to ripen most of their bunches. The ripening of normal bunches on *pisifera* palms is said to take place more readily as the palms grow older and is also said to be induced by severe leaf pruning. In any case the great majority of "sterile" palms are either completely useless or nearly so, and the average yield from such palms in Nigeria has been found to be negligible. The aim in the selection programme must, therefore, be to avoid the occurrence of *pisifera* palms in the progeny of selected trees. *Up to the present "sterile" palms have only been found to occur in the progeny of thin-shelled or "tenera" trees.* The seriousness of the problem of sterility will be apparent from the following table which shows the number and percentage of sterile palms occurring in some of the selection plots at various stations in Nigeria.

Station.	No. of normally developed thin-shelled progenies which are 6 years old or more.	Palms which are undoubtedly sterile.	Palms which are doubtful.	Percentage of undoubtedly sterile palms.
Benin .	209	56	6	26·8
Umuahia.	236	41	3	17·3
Ibadan .	179	30	15	16·8
Onitsha .	188	42	2	22·3
Total .	812	169	26	20·8

The number of *self-pollinated* progenies of thin-shelled selections occurring in the plots examined is given in column 2. Only those palms which are six years old or more and which are normally developed, i.e. palms which can be definitely determined as sterile or not, are included in this number. The number of undoubtedly sterile palms included in the progenies of thin-shelled trees is given in column 3, and the percentage of sterile palms is given in the last column. A few palms are doubtful, and the number of these is given in column 4.

Thus in the progeny of *self-pollinated* thin-shelled palms the proportion of sterility is about 20 per cent. Or, put in another way, one palm in five in the progeny of self-pollinated thin-shelled palms is completely useless or nearly so. The seriousness of the problem of sterility is therefore apparent. It should be pointed out that the occurrence of *pisifera* or "sterile" trees in the progeny of *tenera* or thin-shelled palms appears to be quite general; it is not a phenomenon which is peculiar to the thin-shelled selections made in Nigeria. Sterility has been reported in other palm-growing countries, and in the

Belgian Congo it has been found to occur to the extent of 25 per cent. in certain lines.

It should be noted that the figure of 20 per cent. for the proportion of sterile palms in the offspring of thin-shelled palms applies only to the progeny of *self-pollinated* palms. The proportion of sterile palms in the progeny of naturally-pollinated thin-shelled trees is likely to be lower than 20 per cent.

The problem of sterility thus seriously affects the selection programme, and the arrangements for supplying seed for distribution to native farmers. With regard to the question of selection, methods of dealing with the sterility problem either directly or indirectly are now under consideration. It is very fortunate that in Nigeria selection has not been entirely confined to thin-shell palms. There is a good basis of selected thick-shelled material available, which should prove extremely valuable, either for crossing with thin-shelled material or for direct re-selection in an effort to avoid sterility. A direct attack on the problem is also to be made, and various suggestions are under consideration; these include a cytological investigation of sterility, the possibility of recognising sterile palms in the seedling stage (roguing in the nursery), and a study of possible correlations between the parental characters and the proportion of sterility in the progeny.

Oil Palm Seed Germination.—In previous reports (cf. this BULLETIN, 1938, **36**, 239) reference has been made to experimental work which is being carried out in connection with the problem of the germination of oil palm seed. This work has now been in progress for over three years and, as a result, it is possible to report considerable improvement in the germination of oil palm seed.

A vast range of seed treatments, including mechanical, chemical and physical, has now been tried. Perhaps the most important fact which has come to light as a result of this work is that there is a great variability in germination power not only in seed taken from different trees but also in seed from the same tree. The phenomenon has also been noted in Sumatra and in the Belgian Congo.

The importance of variability in germination power of oil palm seed in experimental work is obvious. Bearing this in mind all experiments on germination are now designed on statistical lines, and precautions are also taken to see that the samples subjected to the various experimental treatments all consist of equal numbers of seed from the same trees.

During 1937-38 an experiment designed in this manner was conducted to make a direct comparison of the efficacy of the various standard methods of germination employed on departmental farms and on U.A.C. estates. The most important conclusion reached was that the best germination of oil palm

seed is obtained when the seeds are kept under constantly warm conditions *throughout the whole period of germination.* A heat pre-treatment, even for a period of several weeks, was found not to give a satisfactory germination. The experiment showed that the artificial germinators in use at Ibadan give very good results, and these germinators are now always used in the experiments and for germinating the selected seed received at Ibadan. During 1937 a total of over 40,000 seed, taken from a variety of different trees, was sown in the germinators, and the average germination after six months was 22·2 per cent. while after nine months it was 52·0 per cent. These results are considerably better than were being obtained two or three years ago. An illustrated description of the germinators will be found in an article on "Investigation and Selection in the Oil Palm," by E. H. G. Smith and F. W. Toovey published in *Trop. Agric., Trinidad*, 1938, **15**, 40.

Soya Beans

Uganda.—The following results of variety trials with soya beans planted at Bukalasa are taken from a report on the work of the station for the period July to December 1938. They were planted on March 9 and September 23.

	Yield in lb. per acre.	
	Early rains.	Late rains.
R184 (South Africa)	712	966
Local	922	958
R42 (South Africa)	819	937
R51 (South Africa)	690	735
Palmetto (U.S.A.)	647	733
R304 (South Africa)	635	691
Barberton Y.1	536	550
Significant difference	151	161

The sample of R184, a clean light yellow bean, was the best in appearance from each crop. Barberton Y.1 and R304 are the earliest to mature and Local and R184 the latest. In the second crop the early maturing varieties, which were yellowing at the time, were damaged by *Locusta migratoroides*, whilst the late maturing varieties, still green at the time, were passed over.

Fibres

Manila Hemp

Malaya.—According to the report of T. D. Marsh, Acting Senior Agriculturist, for the half-year July-December 1938, Manila hemp fibre has been successfully prepared by means of the Hagotan stripping machine. Samples sent to London were favourably reported upon and valued at £19 10s. to £25 per ton according to variety.

Drugs

Kola

Nigeria.—The following statement by O. J. Voelcker on the inheritance of colour in the cotyledons of kola is taken from the report of the Botanical Section, Southern Provinces, for the period July to December 1938.

In the report for January-June 1935 (this Bulletin, 1935, **33,** 379) notes were made on the factors which determined colour in the " nuts " or cotyledons of kola. It then appeared that absence of colour (white or palish green) was a recessive character, and, consequently, that trees grown from white nuts would breed true. Subsequent work undertaken by Mr. F. W. Toovey confirmed the fact that absence of colour was recessive. His further investigations showed that kola grown from pink nuts also bred true to pink cotyledon colour when self-fertilised. But when he came to test the inheritance of cotyledon colour from trees grown from red nuts—and these form the bulk of the kola grown in Nigeria—he found, with possibly one exception, no red tree which would set fruit on self-fertilisation, but such trees would set fruit freely if crossed with pollen from other red trees, or from white or pink trees. The discovery of self-incompatibility among all the red trees tested is of undoubted importance, and if self-incompatibility exists to such an extent among the Nigerian kola farms, then the agents responsible for cross-pollination must determine the yield obtained.

Our present knowledge on the genetics of cotyledon colour in kola may be summarised as follows :

If W, P and R designate trees grown from white, pink and red nuts respectively, then :

(1) W selfed or W × W will give only white nuts.

(2) P selfed or P × P will give only pink nuts.

(3) R selfed does not set fruit, but R × R will give only red nuts.

(4) W × P and P × W will give a mixture of red, pink and white nuts.

(5) W × R and R × W will give either all red or a mixture of red and pink nuts.

Basing conclusions on (1) and (2), kola at experimental farms has been planted in isolated blocks according to the colour of the nuts used. Thus at Owena and Ibadan plots were planted in 1934 and 1935 with self and cross fertilised seedlings from white trees ; at Nkwele a plot was planted in 1936 with similar material but including open pollinated seedlings from white nuts selected from different localities in Nigeria. Isolated

plots have also been planted at Ibadan and Benin with seedlings germinated from pink nuts resulting from controlled and open pollination. A further plot has been set aside at Ibadan for establishing a collection of interesting kola types irrespective of cotyledon colour.

As a result of the investigations on cotyledon colour, a number of seedlings obtained from groups 3, 4 and 5 above were planted in 1937 at a very close spacing with the object of studying the inheritance of colour. Until these trees come into bearing, it is difficult to plan further work on the problem.

FORESTRY

Gums and Resins

Jelutong

Malaya.—The following statement is contained in a report by C. D. V. Georgi, Senior Chemist, for the half-year July-December 1938.

In connection with the alleged rapid resinification of jelutong from Borneo compared with the Malayan product a lengthy investigation has been carried out for an estate in Brunei to determine whether any connection exists between resin content or mineral content and susceptibility to resinification. The results of experiments showed, however, no correlation in these respects. The only recommendations that could be made to ensure a product with better storage qualities were (*a*) closer attention to cleanliness in collecting and coagulating the latex and (*b*) a thorough refining of the crude coagulum with boiling water to reduce the serum solids in the refined jelutong to a minimum.

Pine Resin

Cyprus.—According to a report on research work conducted by the Forest Department during the period July to December 1938, the resin tapping experiments previously reported upon were continued for the second year. The yield averaged 13·5 oz. per tree which is 68 per cent. better than results obtained in 1937. The trees tapped were all small trees of less than 50 years, the majority of which were less than 30 in. in girth. In view of the fact that the Imperial Institute has reported favourably on Cyprus resin (see this Bulletin, 1938, **36**, 157) it is proposed to lay down extensive field experiments on mature trees during 1939.

BIBLIOGRAPHY

Comprising the more important reports, articles, etc., contained in publications received in the Library of the Imperial Institute during the three months February-April 1939.

The publications issued by the Governments of the Colonies and Protectorates can be obtained from or through the Crown Agents for the Colonies, 4 *Milbank, Westminster, S.W.*1. *Applications for Dominion and Indian Government publications may be made to the Offices of the High Commissioners or Agents-General in London.*

AGRICULTURE

General

Ninth Annual Report of the Executive Council, Imperial Agricultural Bureaux, for 1937-1938. Pp. 64, $9\frac{1}{2} \times 7\frac{1}{2}$. (London: H.M. Stationery Office, 1939.) Price 2*s*. 6*d*.

Annual Report of the Imperial Economic Committee covering the period April 1, 1937 to March 31, 1938. Pp. 15, $9\frac{1}{2} \times 6$. (London: H.M. Stationery Office, 1938.) Price 6*d*.

Twelfth Annual Report of the Council for Scientific and Industrial Research, Australia, for the year 1937-38. Pp. 96, 13×8. (Canberra: Commonwealth Government Printer, 1938.) Price 4*s*.

Report of the Department of Agriculture, New South Wales, for the year ended June 30, 1938. Pp. 44, 13×8. (Sydney: Government Printer, 1938.) Price 2*s*. 9*d*.

Fifty-ninth Report of the Department of Lands, New South Wales, for the year ended June 30, 1938, and Reports by the Prickly-pear Destruction Commissioner, and the Western Lands Commissioner for the same period. Pp. 28, 13×8. (Sydney: Government Printer, 1938.) Price 2*s*.

The Climate of Tropical Australia in Relation to Possible Occupation. By J. A. Prescott. *Trans. Roy. Soc. S. Aust.*, 1938, **62**, 229-240.

Annual Report of the Department of Agriculture, Tasmania, for 1937-38. Pp. 26, 13×8. (Hobart: Government Printer, 1938.)

Annual Report of the Department of Agriculture, Western Australia, for the year ended June 30, 1938. Pp. 33, 13×8. (Perth: Government Printer, 1938.)

Annual Report of the British Somaliland Veterinary and Agricultural Department for 1938. Pp. 23, 13×8. (Burao: Veterinary and Agricultural Department, 1939.) Mimeographed.

Report of the Minister of Agriculture for the Dominion of Canada for the year ended March 31, 1938. Pp. 117, $9\frac{3}{4} \times 6\frac{1}{2}$. (Ottawa: King's Printer, 1938.) Price 25 cents.

Progress Report of the Dominion Botanist, Division of Botany, Department of Agriculture, Canada, for the years 1935 to 1937 inclusive. Pp. 100, $9\frac{3}{4} \times 6\frac{1}{2}$. (Ottawa: Department of Agriculture, 1938.)

Report of the Department of Lands and Forests, Province of Nova Scotia, for the year ended November 30, 1938. Pp. 101, $9\frac{3}{4} \times 6\frac{1}{2}$. (Halifax, N.S.: King's Printer, 1939.)

Report of the Minister of Agriculture, Province of Ontario, for the year ending March 31, 1938. Pp. 132, $9\frac{3}{4} \times 6\frac{1}{2}$. (Toronto: King's Printer, 1938.)

Rapport du Ministre de l'Agriculture de la Province de Québec pour l'année finissant le 30 juin, 1938. Pp. 123, $9\frac{3}{4} \times 6\frac{3}{4}$. (Quebec: King's Printer, 1938.)

The Progress of Agricultural Science in India during the past twenty-five years. By W. Burns. *Misc. Bull. No.* 26, *Imp. Coun. Agric. Res. India.* Pp. 49, 9¾ × 7¼. (Delhi: Manager of Publications, 1939.) Price Re. 1 As. 8.

Agriculture and Animal Husbandry in India in 1936-37. Pp. 503, 9½ × 7. (Delhi: Manager of Publications, 1939.) Price Rs. 7. Records the progress made in all branches of agriculture and animal husbandry research and development during this period.

Report of the Department of Agriculture in the Central Provinces and Berar for the year ending March 31, 1938. Pp. 42, 9½ × 6¼. (Nagpur: Government Printing, 1939.) Price Re. 1 As. 8.

Report on the Department of Agriculture, Madras Presidency, for the year 1937-38. Pp. 71, 9¾ × 6. (Madras: Superintendent, Government Press, 1938.) Price As. 6.

Annual Report of the Department of Agriculture,in Sind for the year ending June 30, 1937. Pp. 251, 9½ × 6. (Karachi: Government Book Depot, 1938.) Price Re. 1.

Annual Report of the Department of Agriculture, Kenya Colony and Protectorate for 1937. Volume I. Pp. 142, 9¾ × 6. (Nairobi: Government Printer, 1939.) Price 2*s.* 6*d.* Gives a review of agriculture in Kenya for the year and an account of the work of the Department.

Annual Report of the Department of Agriculture, Mauritius, for 1937. Pp. 73, 9½ × 6¼. (Port Louis: Government Printer, 1939.) Price Re. 1.

Scientific and Industrial Research, 1927-1938. *Bull. No.* 69, *Dep. Sci. Industr. Res. N.Z.* Pp. 113, 9½ × 7¼. (Wellington, N.Z.: Government Printer, 1938.) Price 2*s.* 6*d.* Describes the main lines of research upon which the Department is engaged and the results which have been obtained since its establishment in 1927.

Annual Report of the Agricultural Department, Nigeria, for the year 1937. Pp. 38, 13 × 8. (Lagos: Government Printer, 1938.) Price 3*s.* 6*d.*

Annual Report of the Department of Agriculture and Forests, Sudan, for the year 1937. Part I. Administrative and General. Part II. The Report of the Agricultural Research Service. Part I. Pp. 116, 9½ × 6½. Part II. Pp. 139, 9½ × 6½. (Sudan: Department of Agriculture and Forests, 1939.)

Annual Report of the Department of Agriculture, Tanganyika Territory, 1937. Part II. Pp. 47, 9¾ × 6¾. (Dar es Salaam: Government Printer, 1939.) Price 2*s.* 6*d.* Comprises the reports of the Senior Agricultural Officers in the North-western Circle, the North-eastern Circle, and the South-eastern Circle respectively.

Report of the Chief of the Bureau of Plant Industry, United States Department of Agriculture, 1938. Pp. 37, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Agricultural Research in Colorado. Fifty-first Annual Report of the Colorado Experiment Station, 1937-38. Pp. 61, 9 × 6. (Fort Collins: Colorado State College, 1938.)

Ninth Biennial Report of the Director, Agricultural Experiment Station, Kansas Stage College of Agriculture and Applied Science, for the Biennium, July 1, 1936 to June 30, 1938. Pp. 145, 9 × 6. (Manhattan, Kansas: Agricultural Experiment Station, 1938.)

Fifty-seventh Annual Report of the New York State Agricultural Experiment Station for the year ended June 30, 1938. Pp. 44, 9 × 5¾. (Geneva, N.Y.: Agricultural Experimental Station, 1938.).

Forty-eighth Annual Report of the Agricultural Experiment Station, Pullman, Washington, for the year ended June 30, 1938.

Pp. 103, 9 × 6. (Pullman, Washington: Agricultural Experiment Station, 1938.)

Report of the Water Conservation and Irrigation Commission, New South Wales, for the year ended June 30, 1938, together with Report of the Dried Fruits Board for the same period. Pp. 48, 13 × 8. (Sydney: Government Printer, 1938.) Price 3*s.*

Report of the Director of Irrigation, Union of South Africa, for the period April 1, 1937 to March 31, 1938. Pp. 37, 13 × 8. (Pretoria: Government Printer, 1939.) Price 2*s.*

Les Limites de l'Agriculture non Irriguée en Afrique. By F. R. Falkner. *Rev. Bot. Appl.*, 1939, **18**, 844-854.

Vegetation of South Africa. By R. S. Adamson. Pp. 235, 8¾ × 5½. (London: British Empire Vegetation Committee, 1938.) Price 10*s.*

Crops and Plant Breeding. By G. D. H. Bell. *J. Roy. Agric. Soc.*, 1938, **99**, 115-163. A survey of research work conducted during 1937 on grassland, potatoes, barley, wheat, oats, etc., and on various aspects of plant breeding.

Increasing "Plant" Efficiency. By C. D. Ingersoll. *Chem. Metall. Engng.*, 1939, **46**, 22-23. An account of hydroculture.

The Effect of Hetero-Auxin on Root Formation by Cuttings and on Grafting. Part II. By M. Evenari, E. Konis and D. Zirkin. *Palestine J. Bot.* (*Jerusalem Series*), 1939, **1**, 125-130.

Eradication of Cornfield Weeds. By H. C. Long. *J. Minist. Agric.*, 1939, **46**, 51-53.

Destruction of Gorse and Blackberry. Methods of Eradication and Control. By J. E. Bell. *N.Z. J. Agric.*, 1939, **58**, 111-116.

The Bracken Fern and Its Eradication. By M. Cullity. *J. Dep. Agric. W. Aust.*, 1938, **15**, 414-420.

The Soil

An Examination of Some Soils from the More Arid Regions of Australia. By J. A. Prescott and H. R. Skewes. *Trans. Roy. Soc. S. Aust.*, 1938, **62**, 320-341.

A Soil Survey of the Merbein Irrigation District, Victoria. By F. Penman, J. K. Taylor, P. D. Hooper and T. J. Marshall. *Bull. No.* 123, *Coun. Sci. Industr. Res. Aust.* Pp. 44, 9½ × 6. (Melbourne: Government Printer, 1939.)

Soil Survey of Duvauchelle Bay, Wainui District, Banks Peninsula. By C. S. Harris and A. C. Harris. *Bull. No.* 65, *Dep. Sci. Industr. Res., N.Z.* Pp. 13 + map, 9¾ × 6. (Wellington, N.Z.: Government Printer, 1939.) Price 1*s.* 3*d.*

Soil Improvement in the Sudan Gezira. By H. Greeve and O. W. Snow. *J. Agric. Sci.*, 1939, **29**, 1-34.

Report of the Chief of the Bureau of Chemistry and Soils, United States Department of Agriculture, 1938. Pp. 55, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Report of the Soil Conservation Committee, South Australia, together with Maps and Appendices. Pp. 73, 13 × 8. (Adelaide: Government Printer, 1938.)

Drain of India's Agricultural Wealth on the Problem of Soil Erosion in India. By K. V. Joshi and N. V. Kanitkar. *Agric. Live-Stk., India*, 1939, **9**, 10-25.

Some Aspects of Soil Conservation. Based on Observations in the Central and North Kavirondo Native Reserves, Kenya. By A. W. Thompson. *E. Afr. Agric. J.*, 1939, **4**, 272-277.

Soil Erosion in St. Vincent, B.W.I. By F. Hardy. *Trop. Agric., Trin.*, 1939, **16**, 58-65.

Soil Erosion in the Union. Conservation of Water and Control

of Soil Erosion by Means of Small Earthen Dams. By P. W. Vorster. *Frmg. S. Afr.*, 1939, **14**, 14, 39.

Report of the Chief of the Soil Conservation Service, United States Department of Agriculture for 1938. Pp. 55, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Native and Adapted Grasses for Conservation of Soil and Moisture in the Great Plains and Western States. By M. M. Hoover. *Frms.' Bull. No.* 1812, *U.S. Dep. Agric.* Pp. 44, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Soil and Water Conservation. By D. Aylen. *Rhod. Agric. J.*, 1939, **36**, 12-30.

Soil Fertility and Tilth in Relation to Soil Erosion. By A. H. E. McDonald. *Agric. Gaz. N.S.W.*, 1939, **50**, 117-120.

The Land in Flood Control. *Misc. Publ. No.* 331, *U.S. Dep. Agric.* Pp. 38, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Soil Salinity in Western Australia. Preliminary Investigations into the Movement of Salt in the Red Brown Earth Zone under a 15 to 25 inch Annual Rainfall. By L. J. H. Teakle. *J. Dep. Agric. W. Aust.*, 1938, **15**, 434-452.

Le Variazioni del Contenuto in Azoto dei Terreni Tropicali. By E. Suckert. *Agricoltura Colon.*, 1938, **32**, 555-559. The variation in the nitrogen content of tropical soils.

Peat Soils and Peat-land Reclamation in Sweden. By H. Osvald. *Emp. J. Exp. Agric.*, 1939, **7**, 21-31.

Memorandum on Composting with Special Reference to Estate Agriculture. Prepared for Submission to the Central Board of Agriculture, November 17, 1938. By T. Eden. *Tea Quart.*, 1939, **11**, 194-199.

Some Methods of Composting Suitable for Small Holdings. *Leafl. No.* 137, *Dep. Agric., Ceylon.* Pp. 2, 10 × 6¼. (Peradeniya: Department of Agriculture, 1938.)

Minor Elements in Fertilizer Practice. By F. Menchikowsky. *Hadar*, 1939, **12**, 47-49. Has special reference to citrus trees.

Pests—General

Report of the Chief of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, 1938. Pp. 84, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

The Locust Outbreak in Africa and Western Asia in 1937. By B. P. Uvarov and W. Milnthorpe. *Publ. Econ. Adv. Coun.* Pp. 64, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 3*s*. Published on the recommendation of the Committee on Locust Control of the Economic Advisory Council. This survey is in continuation of previous surveys and describes the development in the locust situation up to the early months of 1938.

Cutworms. By R. T. M. Pescott. *J. Dep. Agric. Vict.*, 1939, **37**, 37-39. Life history and methods of control.

The Sand Wireworm and Its Control in the South Carolina Coastal Plain. By J. N. Tenhet and E. W. Howe. *Tech. Bull. No.* 659, *U.S. Dep. Agric.* Pp. 38, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents. Deals with the life history and means of control of *Horistonotus uhlerii* Horn, a serious pest of corn, cotton and cowpeas in S. Carolina.

Insecticides

(See p. 233)

Beverages

First Annual Report of the Cocoa Research Station, Tafo, for 1937-1938. By J. Wright. *Bull. No.* 36, *Dep. Agric. Gold Coast.* Pp. 36, 9½ × 6. (Accra: Director of Agriculture, 1938.) Price 1*s.*

Cacao Cultivation and its Application to the Mandated Territory of New Guinea. By E. C. Green. *N. Guinea Agric. Gaz.*, 1938, **4**, No. 4, 2-57.

Recherches Récentes sur le Cacaoyer à Trinidad. By P. Tissot. *Rev. Bot. Appl.*, 1939, **19**, 29-42.

Pests of Cocoa in the Territory of New Guinea. By J. L. Froggatt. *N. Guinea Agric. Gaz.*, 1938, **4**, No. 4, 66-68.

Vergleichende Untersuchungen über die Zusammensetzung der Fette von Keimen, Samenschalen und Kotyledonen der Samen von *Theobroma cacao* Linné. By K. H. Bauer and L. Seber. *Bull. Int. Off. Choc. Cacao, Brux.*, 1939, **9**, 115-124. Comparative research on the composition of fats obtained from the germs, shells and cotyledons of the beans of *Theobroma cacao*. With summary in English.

Butter Fat in Cacao. By H. C. Doyne and O. J. Voelcker. *Trop. Agric., Trin.*, 1939, **16**, 76-78.

Annual Report of the Coffee Board of Kenya for the year ended June 30, 1938. Pp. 68, 8½ × 5½. (Nairobi: The Coffee Board of Kenya, 1938.)

Report of Proceedings at the Coffee Conference, Nairobi, 1938. Pp. 36, 13 × 8. (Nairobi: Coffee Board of Kenya, 1938.) Mimeographed.

De Koffiecultuur in Britsch Oost-Afrika, in het Bijzonder in Kenya. By P. Lamotte. *Bergcultures*, 1939, **13**, 150-156.

Selection within *Coffea arabica* in Tanganyika Territory. By S. M. Gilbert. *E. Afr. Agric. J.*, 1939, **4**, 249-253.

Essai d'un Groupement Systématique des Caféiers Sauvages de Madagascar et des Iles Mascareignes. By A. Chevalier. *Rev. Bot. Appl.*, 1938, **18**, 825-843. An enumeration of the species of *Coffea* occurring in Madagascar and surrounding islands.

Le Café Indénié de la Côte d'Ivoire. By R. Portères. *Agron. Colon.*, 1938, **27**, 161-168. Discusses the classification of coffee from the Indénié Province from the botanical and commercial point of view.

Notes sur la Culture du *Coffea arabica* en Côte d'Ivoire. By Y. Poupart. *Agron. Colon.*, 1938, **27**, 169-172.

La Culture du *Coffea robusta* dans l'Ouest de la Côte d'Ivoire. By Y. Poupart. *Agron. Colon.*, 1938, **27**, 173-180.

Les Dépulpeurs de Café de Fabrication Indigène en Côte d'Ivoire. By R. Portères. *Agron. Colon.*, 1938, **27**, 181-184. Apparatus employed by the natives for depulping coffee in the Ivory Coast.

Le Choix des Variétés et l'Amélioration des Caféiers en Côte d'Ivoire. By R. Portères. *Rev. Bot. Appl.*, 1939, **19**, 18-29.

Production et Commerce du Café en Ethiopie. By P. Tissot. *Rev. Bot. Appl.*, 1939, **19**, 172-177.

Some Reminders on the Manuring of Coffee. By G. H. Gethin-Jones. *Mon. Bull. Coffee Bd., Kenya*, 1939, **5**, 30-32.

A Non-parasitic Disease of Arabica Coffee. By G. B. Wallace. *E. Afr. Agric. J.*, 1939, **4**, 365-368. Discusses the cause and control of a disease characterized by certain symptoms in the bark and wood which results in the death of the trees.

Report of the International Tea Market Expansion Board, Ltd.,

for 1938. Pp. 24, 9½ × 6. (London: The International Tea Market Expansion Board, Ltd.)

Report on Tea Culture in Assam for the year 1937. By S. K. Mitra. Pp. 13, 9½ × 6¼. (Shillong, Assam: Government Press, 1938.) Price As. 5.

The Manuring of Tea. By T. Eden. *Tea Quart.*, 1939, **11**, 187-193.

Cereals

Le Mouvement des Grains dans le Monde. By P. van Hissenhoven. Pp. 858, 9½ × 6¼. (Brussels: Editions Ceres, 1938.) This volume comprises four parts dealing respectively with (1) the characteristics, cultivation, harvesting, etc., of wheat, rye, barley, oats, and maize; (2) the producing and exporting countries; (3) the market at Antwerp and its organisation; (4) other markets.

Stored-grain Pests. By E. A. Back and R. T. Cotton. *Frms.' Bull. No.* 1260 (1938 *Ed.*) *U.S. Dep. Agric.* Pp. 48, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

The Ergot Disease of Rye and other Grains and Grasses. By H. T. Güssow. *Publ. No.* 636 (*Revised*), *Dep. Agric. Canada.* Pp. 3, 8½ × 6½. (Ottawa: Department of Agriculture, 1938.)

Smuts of Cereal and Forage Crops in Kansas and Their Control. By L. E. Melchers. *Bull. No.* 279, *Kans. Agric. Exp. Sta.* Pp. 37, 9 × 6. (Manhattan, Kansas: Agricultural Experiment Station, 1938.)

The Cultivation of Maize. By T. S. Sabnis, M. G. Phatak and C. Maya Das. *Bull. No.* 75, *Dep. Agric. U.P.* Pp. 34, 9½ × 6½. (Allahabad: Superintendent, Printing and Stationery, 1938.) Price As. 3.

Report on the Activities of the British Guiana Rice Marketing Board for the period March 1, 1938, to August 31, 1938. Pp. 6, 13 × 8. (Georgetown, Demerara: "The Argosy" Company, Ltd., 1938.)

Report on Rice Milling in British Guiana. By H. Parker. *Coun. Pap. No.* 3 *of* 1939, *British Guiana.* Pp. 15, 13 × 8. (Georgetown, Demerara: Government Printer, 1939.)

Report of the Essequibo Coast Rice Committee appointed in 1938. *Coun. Pap. No.* 4 *of* 1939, *British Guiana.* Pp. 19, 13 × 8. (Georgetown, Demerara: Government Printer, 1939.)

Padi Planting Methods in Malaya. *Malay. Agric. J.*, 1939, **27**, 40-59. An authoritative article compiled by the Economics Branch of the Department of Agriculture, S.S. and F.M.S., from reports of field officers.

The Ammoniacal Nitrate and Total Nitrogen Contents of Rice Soils. By N. S. Bamji. *Indian J. Agric. Sci.*, 1938, **8**, 839-847.

Studies on Quality in Rice. II. Chemical Composition of Rice Varieties. By V. Sadasivan. *Indian J. Agric. Sci.*, 1938, **8**, 807-818.

Handling Rough Rice to Produce High Grades. By W. D. Smith. *Frms.' Bull. No.* 1420, *U.S. Dep. Agric.* Pp. 22, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Effect of Phytohormone Dusts on Growth and Yield of Winter Wheat Varieties. By G. P. McRostie, J. W. Hopkins and N. H. Grace. *Canad. J. Res.*, 1938, **16**, Sec. C, 510-515.

The Nutritive Value of Wheaten Flour and Bread. By A. M. Copping. *Nutr. Abstr. Rev.*, 1939, **8**, 555-566.

The Truth About Frozen Bread. By W. H. Cathcart. *Food Industr.*, 1939, **11**, No. 2, 68-69, 109-110; No. 4, 200-201, 233-234. Discusses the extent of the possibilities of keeping bread fresh by freezing.

Pulses

A Review of the Literature on the Nutritive Value of Pulses. By R. K. Pal. *Indian J. Agric. Sci.*, 1939, **9**, 133-144.

Marketing the Cowpea Seed Crop. By J. E. Barr. *Frms.' Bull. No.* 1308 (*Revised*), *U.S. Dep. Agric.* Pp. 19, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Weevils in Beans and Peas. By E. A. Back. *Frms.' Bull. No.* 1275, *U.S. Dep. Agric.* Pp. 36, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Sugar

Developments in Mechanical Equipment and Methods in Sugar-beet Production. By E. M. Mervine and S. W. McBirney. *Circ. No.* 488, *U.S. Dep. Agric.* Pp. 38, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Manuring for Sugar Beet. By F. Hanley. *J. Minist. Agric.*, 1939, **45**, 1202-1207.

Experiments on the Spacing of Sugar Beet. I. Results Based on Plot Yields. II. Results Based on Weights of Individual Plants. By F. H. Garner and H. G. Sanders. III. Further Statistical Considerations. By G. B. Hey and W. F. Kemsley. *J. Agric. Sci.*, 1939, **29**, 48-75.

Curly-top-resistant Sugar-beet Varieties in 1938. By F. V. Owen and others. *Circ. No.* 513, *U.S. Dep. Agric.* Pp. 10, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Report of the Indian Tariff Board on the Sugar Industry. Pp. 196, 9½ × 6¼. (Delhi: Manager of Publications, 1938.) Price Rs. 2.

A Preliminary Survey of Soil Types of Sugar Estates of Trinidad with Special Reference to the Allocation of Sugar-cane Varieties. I. The Distribution of Varieties on Sugar Estates in Trinidad. By P. E. Turner. II. Soils of Trinidad Sugar Estates. By C. F. Charter. III. The Relationship of Trinidad Soils to Sugar-cane Varieties. By P. E. Turner and C. F. Charter. Pp. 73, 11 × 7¾. (Trinidad: Sugar-cane Investigation Committee, 1938.)

The Determination of Fibre in Cane. II. By H. W. Kerr. *Tech. Commun. No.* 11 (1938), *Bur. Sug. Exp. Sta., Queensland.* Pp. 244, 9¾ × 7½. (Brisbane: Government Printer, 1938.)

Investigations on the Keeping Quality and Storage of Kitul (*Caryota urens*) Jaggery and Treacle. By A. W. R. Joachim and S. Kandiah. *Trop. Agric., Ceylon*, 1939, **92**, 73-82.

Root Crops

Composition of the Rhizome, Stem and Leaf of Some Horticultural Forms of Canna in Relation to their Possible Use. By C. W. Culpepper and H. H. Moon. *Circ. No.* 497, *U.S. Dep. Agric.* Pp. 22, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Sweet Potatoes in Kansas. By O. H. Elmer. *Bull. No.* 278, *Kans. Agric. Exp. Sta.* Pp. 52, 9 × 6. (Manhattan, Kansas: Agricultural Experimental Station, 1938.)

La Enfermedad de la "Podredumbre Negra" del Camote. By G. C. Rada. *Inf. No.* 46, *Estac. Exp. Agric., La Molina.* Pp. 5, 9½ × 6¼. (Lima, Peru: Estación Experimental Agrícola de La Molina, 1938.) Deals with "black rot" disease of sweet potato.

Sweet Potatoes as Raw Material. By H. S. Paine and W. R. Richee. *Chem. Metall. Engng.*, 1939, **46**, 69-71. Discusses the production of starch from sweet potatoes.

The Distribution and Significance of Certain Potato Viruses in Scotland. By G. Cockerham. *Scot. J. Agric.*, 1939, **22**, 1-11.

Time of Irrigating Potatoes as Affecting Stolon Growth and Tuber Set and Development. By W. C. Edmundson. *Circ. No.* 496, *U.S. Dep. Agric.* Pp. 18, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Manuring for Potatoes. By F. Hanley. *J. Minist. Agric.*, 1939, **45**, 1101-1106.

Converting Surplus Potatoes into Valuable Stock Feed. Utilising Potato Silage to Eliminate Waste of Crops. By C. E. Ballinger. *N.Z. J. Agric.*, 1939, **58**, 119-122.

Fruits

Fruit Production: Tree Fruits. *Bull. No.* 2 (*3rd Ed.*), *Minist. Agric., Lond.* Pp. 115, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 2*s.* 6*d.*

Fruit Production in the Union. Report No. 20. The 1936-37 Deciduous Fruit Export Season. *Bull. No.* 187, *Dep. Agric. Un. S. Afr.* Pp. 138, 9½ × 6. (Pretoria: Government Printer, 1939.) Price 1*s.*

Artificial Ripening of Fruits with Acetylene. By D. Kaltenbach. *Int. Rev. Agric.*, 1939, **30**, 1T-10T.

Microbiology of Fruit in Relation to Certain Fruit Products. By V. L. S. Charley. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 115-117.

Twelfth Annual Report of the Australian Canned Fruits Board for the year 1937-38, together with a Statement regarding the Canned Fruits Exports Control Act, 1926-1938. Pp. 27, 13 × 8. (Canberra: Commonwealth Government Printer, 1938.) Price 1*s.* 3*d.*

The Cold Storage of Fruits and Vegetables. By G. S. Cheema and D. V. Karmarkar. *Misc. Bull. No.* 23, *Imp. Coun. Agric. Res. India.* Pp. 15, 9½ × 7½. (Delhi: Manager of Publications, 1939.) Price As. 10.

Données Récentes sur le Jus de Fruits en Conserve. By H. Cheftel. *Rev. Int. Prod. Colon.*, 1939, **14**, 137-141. Discusses various principles in the preservation of fruit juices.

The Control of the Woolly Aphis by *Aphelinus mali.* By L. J. Dumbleton and F. J. Jeffreys. *N.Z. J. Sci. Tech.*, 1939, **20**, 183A-190A.

Notes on the Propagation of the Ponderosa Chico. By P. A. Rodrigo. *Philipp. J. Agric.*, 1938, **9**, 357-362. Deals with *Achras zapota* Linn. var. *ponderosa.*

Avocado Culture. By F. G. Galang. *Philipp. J. Agric.*, 1938, **9**, 315-325.

Storage Investigations with Trinidad Avocados, 1938. By C. W. Wardlaw. *Trop. Agric., Trin.*, 1939, **16**, 28-30.

The Storage of Sweet Cherries as Influenced by Carbon Dioxide and Volatile Fungicides. By B. W. Heywang. *Tech. Bull. No.* 631, *U.S. Dep. Agric.* Pp. 20, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

The Culture of Citrus Fruits in South Australia. By F. R. Arndt. *J. Dep. Agric. S. Aust.*, 1938, **42**, 476-485; 781-790.

The Citrus Industry in São Paulo (Brazil). By A. Neugarten. *Hadar*, 1939, **12**, No. 1, 15-16.

A Study of the Methods of Cultivation of Fruit Trees with special reference to Citrus. By Sohrab R. Gandhi. *Trop. Agric., Ceylon*, 1939, **92**, 3-15.

Le Cédrat en Cochinchine. By B. Tkatchenko. *Bull. Écon. Indochine*, 1938, **41**, 1389-1412. An account of *Citrus* spp. cultivated in Cochin China and the products obtained from them.

Citrus Cultivation in the U.S.S.R. By A. Pascual. *Int. Rev. Agric.*, 1939, **30**, 45T-50T.

The Control of Scab and Certain Other Diseases and Pests of Grapefruit by Fungicides and Insecticides. By R. E. D. Baker. *Trop. Agric., Trin.*, 1939, **16**, 31-34.

Orange Cultivation and Production in Spain. *Hadar*, 1939, **12**, No. 1, 9-12.

Cranberry Juice. Properties and Manufacture. By C. C. Rice, C. R. Fellers and J. A. Clague. *Fruit Prod. J.*, 1939, **18**, 197-200.

Date Growing in the United States. By R. W. Nixon. *Leafl. No.* 170, *U.S. Dep. Agric.* Pp. 8, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

The Culture of the Grape Vine in Queensland. By F. L. Jardine. *Queensld. Agric. J.*, 1939, **51**, 136-172.

The Bud-graft Method of Propagating Vinifera Grape Varieties on Rootstocks. By E. Snyder. *Leafl. No.* 173, *U.S. Dep. Agric.* Pp. 5, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

The Cause and Control of Wastage in Grapes. By J. Reyneke. *Frmg. S. Afr.*, 1939, **14**, 64-66, 68.

Pests of the Grape Vine. By J. H. Smith. *Queensld. Agric. J.*, 1938, **50**, 700-707.

Grape Vine Diseases in Queensland. By R. B. Morwood. *Queensld. Agric. J.*, 1939, **51**, 5-16.

Bacterial Blight in Vines. *Frmg. S. Afr.*, 1939, **14**, 55-59.

Summary of a Report on the Sultana and Table Grape Industries in Crete. By S. Michal. *Cyprus Agric. J.*, 1938, **33**, 106-113.

Wine-making. By C. J. Theron and C. J. G. Niehaus. *Bull. No.* 191, *Dep. Agric. Un. S. Afr.* Pp. 98, 9½ × 6. (Pretoria: Department of Agriculture, 1938.)

Tenth Annual Report of the Australian Wine Board for the year 1937-38, together with statement regarding the operation of the Wine Overseas Marketing Act, 1929-36. Pp. 13, 13 × 8. (Canberra: Commonwealth Government Printer, 1938.) Price 9*d*.

Investigations on the Cold Storage of Mangoes. By G. S. Cheema, D. V. Karmarkar and B. M. Joshi. *Misc. Bull. No.* 21, *Imp. Coun. Agric. Res. India.* Pp. 69, 9½ × 7½. (Delhi: Manager of Publications, 1939.) Price Rs. 3 As. 12.

Een Voorloopig Beknopt Overzicht van de Plagen van de Mangga. By C. J. H. Franssen. *Meded. No.* 31, *Alg. Proefst. Landb. Buitenzorg.* Pp. 24, 10 × 7. (Buitenzorg: Archipel Drukkerij, 1938.) Price f. 0.45. Pests of the mango tree in the Netherlands East Indies. With summary in English.

Watermelon and Sweet Melon Cultivation in Palestine. *Agric. Suppl. No.* 39, *Palestine Gaz.*, 1939, 52-55.

A Preliminary Survey of the Watermelon Industry in Bulacan and Pampanga. By A. L. Tecson. *Philipp. J. Agric.*, 1938, **9**, 365-378.

Grease-spot of Passion Fruit. By W. D. Reid. *N.Z. J. Sci. Tech.*, 1939, **20**, 260A-265A. Deals with the symptoms, causes and method of control of this bacterial disease.

Control of Black Rot of Pineapples in Transit. By C. O. Bratley and A. S. Mason. *Circ. No.* 511, *U.S. Dep. Agric.* Pp. 12, 9 × 6.

(Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

The Argentine Pear Industry. By P. O. Nyhus. *Foreign Agric.*, 1939, **3**, 15-26.

The Strawberry and Its Cultivation in Canada. By M. B. Davis and D. S. Blair. With a section on Common Strawberry Insects and Control by W. A. Ross, and a section on Common Strawberry Diseases and their Control by G. H. Berkley. *Publ. No.* 621, *Dep. Agric. Canada.* Pp. 43, $9\frac{3}{4} \times 6\frac{1}{2}$. (Ottawa: Department of Agriculture, 1938.)

Tomato Culture. By B. P. Krone. *J. Dep. Agric. Vict.*, 1939, **37**, 64-69.

Tomatoes as a Truck Crop. By W. R. Beattie. *Frms.' Bull. No.* 1338 (*Revised*), *U.S. Dep. Agric.* Pp. 36, 9×6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

The Development of the Cashew-nut Industry in India. By I. A. Sayed. *Agric. Live-Stk. India*, 1939, **9**, 26-41.

The Pecan Nut. By J. G. Baxter. *J. Dep. Agric. Vict.*, 1939, **37**, 25-27.

Pecan Soils of the Gulf and South-eastern States and Maintenance of their Fertility. By J. J. Skinner, E. D. Fowler and A. O. Alben. *Circ. No.* 492, *U.S. Dep. Agric.* Pp. 24, 9×6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Spices

The Effect of Manuring on the Incidence of Chilli Leaf-curl. By W. R. C. Paul and M. Fernando. *Trop. Agric., Ceylon*, 1939, **92**, 23-27.

Chilli Leaf-curl Experiments. I. Preliminary Infection Tests. By A. L. Johnpulle. *Trop. Agric., Ceylon*, 1939, **92**, 28-30.

Cardamoms. By W. Molegode. *Trop. Agric., Ceylon*, 1938, **91**, 325-332. An account of the cultivation, harvesting, method of curing, grading, and packing of cardamoms.

La Selección como Medio de Lucha contra la Marchitez del Aji. By T. B. Barducci. *Inf. No.* 43, *Estac. Exp. Agric., La Molina.* Pp. 9, $9\frac{1}{2} \times 6\frac{1}{4}$. (Lima, Peru: Estación Experimental Agricola de La Molina, 1938.) Selection as a means of control of wilt of capsicums.

Vegetables

Yields of Asparagus as Affected by Severe Cutting of Young Plantations. By J. W. Lloyd and J. P. McCollum. *Bull. No.* 448, *Ill. Agric. Exp. Sta.* Pp. 13, 9×6. (Urbana, Illinois: Agricultural Experimental Station, 1938.)

Varieties of Garden Beans in New South Wales. By N. S. Shirlow. *Frms.' Bull. No.* 171, *Dep. Agric. N.S.W.* Pp. 44, $9\frac{1}{2} \times 6$. (Sydney: Government Printer, 1938.)

Lettuce Kraut and Juice. By W. V. Cruess and R. Gilliland. *Fruit Prod. J.*, 1939, **18**, 231-232, 251. Describes experiments on the utilisation of cull and surplus lettuces.

Diseases of Lettuces. I. *Macrosporium* Leaf Spot. By B. J. Dippenaar. *Frmg. S. Afr.*, 1939, **14**, 101-103, 106.

Mushroom Culture. By H. T. Güssow. *Publ. No.* 638 (Revised), *Dep. Agric. Canada.* Pp. 4, $8\frac{1}{2} \times 6\frac{1}{2}$. (Ottawa: Department of Agriculture, 1938.)

"Brown Heart" of Swedes. By F. T. Bennett and L. E. Edney. *J. Minist. Agric.*, 1939, **45**, 1232-1239.

Brown-heart in Swedes. Trials with Application of Borax. By C. S. Dalgleish. *N.Z. J. Agric.*, 1938, **57**, 511-513.

The Talinum: Its Culture and Uses. By N. G. Teodoro. *Philipp. J. Agric.*, 1938, **9**, 395-399. Describes the plant *Talinum triangulare* Jacq. and its use as a vegetable.

The Effect of Cooking and Canning on the Mineral Constituents of Certain Vegetables. By G. Horner. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 86-90.

Fodders and Forage Crops

The Nutritive Values of Indian Cattle Foods and the Feeding of Animals. By K. C. Sen. *Misc. Publ. No.* 25, *Imp. Coun. Agric. Res. India.* Pp. 39, 9½ × 7½. (Delhi: Manager of Publication, 1938.). Price As. 7.

Improved Method for Estimating Carotene in Feeds. By G. S. Fraps and A. R. Kemmerer. *J. Ass. Off. Agric. Chem., Wash.*, 1939, **22**, 190-195.

Loss, During Storage, of Vitamin A from Alfalfa Leaf Meals Fed to Chickens. By B. W. Heywang. *Tech. Bull. No.* 632, *U.S. Dep. Agric.* Pp. 8, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Lygus Bugs in Relation to Alfalfa Seed Production. By C. J. Sorenson. *Bull. No.* 284, *Utah Agric. Exp. Sta.* Pp. 61, 9 × 6. (Logan, Utah: Agricultural Experiment Station, 1939.) Discusses the biology, life-history, and methods of control of *Lygus hesperus* and *L. elisus*.

The Lucerne Flea (*Smynthurus viridis*) in New Zealand. By L. J. Dumbleton. *N.Z. J. Sci. Tech.*, 1939, **20**, 197A-211A.

Brewers' Grains (Fresh) as a Pig Food. Results of Experiments at Wye. By V. C. Fishwick. *J. Inst. Brew.*, 1939, **45**, 119-120.

Citrus Meal for Livestock and Poultry. By J. S. Braverman. *Hadar*, 1939, **12**, No. 1, 5-6.

Grass Culture and Range Improvement in the Central and Southern Great Plains. By D. A. Savage. *Circ. No.* 491, *U.S. Dep. Agric.* Pp. 56, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

The Temporary Ley. *Bull. No.* 15, *Series H*, *Welsh Pl. Breed. Sta.* Pp. 150, 9½ × 7½. (Aberystwyth: Welsh Plant Breeding Station, 1939.) Price 7*s.* 6*d.* Contains four sections as follows: Temporary Leys: Comparison of Station-bred and Commercial Grasses used in Simple Mixtures. By W. Davies. An Experiment in the Yield and Persistency of Strains of Grass and Clover Species Grown in Mixtures, and an Experiment on the Blending of Species in Simple Mixtures. By W. E. J. Milton. Pasture Management and Its Effect in the Sward. By L. I. Jones. The Establishment and Maintenance of Temporary Leys. By Sir R. G. Stapledon.

The Conservation of Forage Crops with Special Reference to Grass. By S. J. Watson. *Emp. J. Exp. Agric.*, 1939, **7**, 43-50.

Grass and Crop Drying on a Yorkshire Mixed Farm. By C. Bowles. *J. Minist. Agric.*, 1939, **45**, 1093-1100.

The Comparative Feeding Value of Grass When Fed Green, as Hay, and as Silage. By M. H. French. *E. Afr. Agric. J.*, 1939, **4**, 261-264.

The Influence of Frequency of Cutting on the Yield, Chemical Composition, Digestibility and Nutritive Value of Some Grass Species. By J. G. Louw. *Onderstepoort J. Vet. Sci.*, 1938, **11**, 163-244.

The Cultivation of Perennial Fodder Grasses in Trinidad. By D. D. Paterson. *Trop. Agric., Trin.*, 1939, **16**, 55-57.

A Revision of the Paspalum Grasses in New South Wales. By D. O. Cross. *Sci. Bull. No.* 59, *Dep. Agric. N.S.W.* Pp. 27, 9½ × 6. (Sydney: Department of Agriculture, 1938.)

The Timothy Crop. By M. W. Evans. *Leafl. No.* 171, *U.S. Dep. Agric.* Pp. 6, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents. The growing and utilisation of timothy as a fodder crop.

La Graine de Lupin (Poudre Entière et Tourteau) et son Emploi Alimentaire. By A. Guillaume and A. Proeschel. *Rev. Bot. Appl.*, 1939, **19**, 161-172. Gives an account of the chemical examination of the seeds of *Lupinus albus* and *L. luteus*, discusses their uses for foodstuffs and fodders, and gives particulars of the oils obtained from the seeds of both species.

The Preservation of Maize for Fodder. By A. R. Saunders. *Frmg. S. Afr.*, 1939, **14**, 133, 155.

The Chemical Composition of Maize-germ Meal. By J. W. Groenewald. *Frmg. S. Afr.*, 1939, **7**, 136, 155.

Oat Mill Feed in Livestock Rations. By G. Bohstedt and A. W. Lathrop. *Bull. No.* 441, *Wis. Agric. Exp. Sta.* Pp. 55, 9 × 6. (Wisconsin, Madison: Agricultural Experiment Station, 1938.) Oat mill feed is the ground mill-run by-product of oat meal manufacture.

Evening Primrose (*Oenothera odorata*). By R. C. Scott. *J. Dep. Agric. S. Aust.*, 1939, **42**, 624-628. Deals with the cultivation of the plant and discusses its uses with special reference to its value as a fodder crop.

Potato Silage. By S. Williams. *J. Minist. Agric.*, 1939, **45**, 1218-1223. An economical method of conserving potatoes for feeding to pigs.

Spineless Cactus and Old-Man Saltbush for Sheep. By J. G. Marais and H. C. Bonsma. *Frmg. S. Afr.*, 1939, **14**, 99-100.

British Cod Liver Oil: Its Production, Properties, and Uses as a Feeding-stuff. By K. MacLennan. *J. Minist. Agric.*, 1939, **45**, 1245-1257.

Oils and Oil Seeds

Vegetable Oils and Oilseeds. A Summary of Figures of Production, Trade and Consumption relating to Cottonseed, Linseed, Soya Beans, Groundnuts, Copra, Oil Palm Products, Olive Oil, and other Oilseeds and Oils. *Publication of the Imperial Economic Committee.* Pp. 117, 10 × 7¼. (London: H.M. Stationery Office, 1938.) Price 2*s.* 6*d.*

Review of the Oil and Fat Markets, 1938. Pp. 112, 10 × 8. (London: H. M. F. Faure & Co., 1939.)

Culture of Paint Oil Crops for the South. (Possible Alternatives to Cotton.) By H. A. Gardner. Pp. 33, 8½ × 5½. (Washington, D.C.: National Paint Varnish and Lacquer Association, Inc., 1938.) Comprises notes on linseed, perilla, chia, safflower, soya beans, castor, hempseed, sunflower, poppyseed, and tung oil.

Modern Oil Milling. By L. H. Downs. *Oil Col. Tr. J.*, 1939, **95**, 715-722.

Development and Problems of Modern Fat-hardening. By J. Davidsohn and A. Davidsohn. *Food*, 1939, **8**, 242-244.

Industrial Utilisation of Fats and Oils. By A. Guillaudeu. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 158-162.

Die Kultur der Babassúpalme (*Orbignya speciosa* M.). By C. A. Gehlsen. *Tropenpflanzer*, 1939, **42**, 115-119.

Castor Oil. By H. C. Miller. *J. Jamaica Agric. Soc.*, 1939, **43**, 25-29. Notes on the uses of castor oil and the cultivation of the castor plant with special reference to its possibilities for Jamaica.

Castor Oil. By H. Silman. *Mfg. Chem.*, 1939, **10**, 8-10, 26. General article on the extraction, refining and uses of castor oil.

The Coconut. A Monograph. By J. S. Patel. Pp. 313, $9\frac{3}{4} \times 6$. (Madras: Superintendent, Government Press, 1938.) Price Rs. 3 As. 12. A comprehensive study of the cultivation of the coconut and on coconut products and their preparation.

Annual Reports of the Geneticist, Coconut Research Scheme, Ceylon, for 1936 and 1937. *Bull. No.* 4, *Coconut Res. Scheme* (*Ceylon*). Pp. 57, $9\frac{1}{2} \times 7\frac{1}{4}$. (Lunawila: Coconut Research Scheme, 1938.)

The Present Position of the Local Copra Industry. By H. W. Jack. *Agric. J. Fiji*, 1939, **10**, No. 1, 2-5.

Suggestions for the Improvement of New Guinea Copra. The Employment of Sulphur Dioxide Gas in the Curing of Copra. By E. C. Kelly. *N. Guinea Agric. Gaz.*, 1938, **4**, No. 4, 63-66.

The Economics of Peanut and Maize Production on the Springbok Flats. By F. R. Tomlinson. *Bull. No.* 196, *Dep. Agric. Un. S. Afr.* Pp. 152, $9\frac{1}{2} \times 6$. (Pretoria: Government Printer, 1938.) Price 1s.

The Fatty Acids and Glycerides of the Solid Seed Fats. VIII. The Seed Fat of *Hodgsonia capniocarpa*. By T. P. Hilditch, M. L. Meara and W. H. Pedelty. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 26-29.

The Fatty Acids and Glycerides of Solid Seed Fats. VII. Dika Fat. By W. J. Bushell and T. P. Hilditch. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 24-26. Deals with the seed fat of *Irvingia gabonensis* from Sierra Leone.

Les deux Stations Expérimentales du Palmier à Huile. By A. Aubréville. *Rev. Bot. Appl.*, 1939, **19**, 1-14. An account of selection work carried out with oil palms at la Mé in the Ivory Coast and Pobé in Dahomey.

Olive Growing in the South-western United States. By C. F. Kinman. *Frms.' Bull. No.* 1249 (*Revised*), *U.S. Dep. Agric.* Pp. 32, 9×6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Results of Perilla and Chia Planting Experiments in 1937 and Outline of 1938 Larger Scale Plantings. By F. Scofield. *Circ. No.* 565, *Sci. Sect., Nat. Paint, Varn., Lacq. Ass.* Pp. 7, $8\frac{1}{2} \times 5\frac{1}{2}$. (Washington, D.C.: National Paint, Varnish and Lacquer Association, Inc., 1938.)

Cultivo Económico del Ajonjolí. By F. G. Venegas. *Rev. Agric., Habana*, 1938, **21**, No. 11, 29-32. The cultivation of sesame.

Le Soja. By E. P. Cheron. *Rev. Int. Prod. Colon.*, 1939, **14**, No. 158, 41-79. A series of articles dealing with soya beans, their cultivation and marketing, the production in the Belgian Congo, and the market conditions for the product in Germany.

A Study of Soybean Varieties with reference to their Use as Food. By S. Woodruff and H. Klaas. *Bull. No.* 443, *Ill. Agric. Exp. Sta.* Pp. 46, 9×6. (Urbana, Illinois: Agricultural Experiment Station, 1938.)

The Soya Bean. Its Importance as a Food. *Food Manuf.*, 1939, **14**, No. 2, 59-61.

Die Sonnenblume (*Helianthus annuus* L.) als Ölpflanze. By A. Fischer. *Fette u. Seifen*, 1939, **46**, 88-89. Gives particulars of the areas under cultivation and yields of sunflower seed in the chief producing countries.

Vegetable Tallow. By S. V. Puntrambekar. *J. Indian Chem. Soc., Industr. and News Ed.*, 1938, **1**, 163-170.

Waxes and Wax-like Products. Their Constitution, Classification and Industrial Utilisation. By L. Ivanovszky. *Oil Col. Tr. J.*, 1939, **95**, No. 2099, 33-39.

The Carnauba Palm and Its Wax. By W. N. Walmsley. *Bull. Pan. Amer. Un.*, 1939, **73**, 31-42.

Synthetische Wachse der I.G. By M. Aschenbrenner. *Fette u. Seifen*, 1939, **46**, 26-29. A review of synthetic waxes prepared by I.G. Farbenindustrie A.-G., Ludwigshafen.

Essential Oils

Perfume Oils of Kenya. Development and Production of Oils of Mawah, Geranium, Lavender, Cedarwood, and others in East Africa. By E. Guenther. *Soap*, 1939, **15**, No. 1, 30-32, 119; No. 2, 26-28, 32.

Zanzibar Distillery. History and Development of the Distillation of Clove Stems in the Protectorate. By A. C. Stirling. *Chem. and Drugg.*, 1939, **130**, 349-350.

Sulle Essenze di Alcuni Gelsomini Spontanei e Coltivabili nell' Impero. By P. Rovesti. *Riv. Ital. Essenze*, 1939, **21**, 51-57. An account of the wild and cultivated jasmins in the Italian Colonies and the characteristics of the oils.

Pharmakologische Vergleichsprüfungen der Öle von *Matricaria chamomilla* L. und *Matricaria discoidea* L. By R. Jaretzky and F. Neuwald. *Arch. Pharm., Berl.*, 1939, No. 1, 50-53. Comparative pharmacological trials with the oils of these two plants.

Physical Characteristics of Florida Orange Oil Produced during 1937-38 Season. By H. W. von Loesecke and G. N. Pulley. *Fruit Prod. J.*, 1939, **18**, 228-230. Reviews the methods now being used in Florida for the production of orange oil.

Algerian Verbena Cultivation. *Chem. and Drugg.*, 1939, **130**, 455.

Contributo allo Studio dell'Olio Essenziale di Verbena (*Lippia citriodora*). By M. G. Igolen. *Riv. Ital. Essenze*, 1939, **21**, 66-68. A study of the chemical composition and characteristics of the essential oil of verbena.

Antiseptic and Bactericidal Power of Essential Oils. By H. Kliewe and E. K. Huthmachen. *Perfum. Essent. Oil Rec.*, 1939, **30**, 61-63.

Fibres

El Cultivo y Beneficio del Lino para Fibra. By J. Paez and J. A. Ocampo. *Circ. No.* 43, *Estac. Exp. Agric., La Molina.* Pp. 19, 9½ × 6¼. (Lima, Peru: Estación Experimental Agricola de La Molina, 1938.) The cultivation and treatment of flax for fibre.

Report on the Flax Industry in Kenya. By W. J. Megaw. Pp. 18, 9¾ × 6. (Nairobi: Government Printer, 1939.) Price 50 cents. Report on a visit to Kenya to investigate the possibilities of the establishment of a flax industry in the Colony.

Kultur und Aufbereitung des Flachses in Peru. *Tropenpflanzer*, 1939, **42**, 63-66. The cultivation and preparation of flax in Peru.

Aanteekeningen over Eenige Ziekten van Roselle en Java-Jute op Java. By H. R. A. Muller and T. van Eek. *Meded. No.* 32, *Alg. Proefst. Landb., Buitenzorg.* Pp. 21, 10 × 7. (Buitenzorg: Archipel Drukkerij, 1939.) Price f. 0.30. Discusses the diseases of *Hibiscus sabdariffa* and *H. cannabinus* in Java. Summary in English.

Abstract Proceedings of the Fourth Meeting of the Indian Central Jute Committee, held at Calcutta in September, 1938. Pp. 52, 9½ × 6¼. (Calcutta: Indian Central Jute Committee, 1938.)

The Kapok Industry in Ceylon. *Ceylon Tr. J.*, 1939, **4**, 5-6.

The Three Destructive Diseases of Abacá in Davao (Bunchy-top, Mosaic, and the Vascular Disease) and their Control. By M. R. Calinisan. *Philipp. J. Agric.*, 1938, **9**, 329-333.

Le Raphia de Madagascar. By R. Dufournet. *Agron. Colon.*, 1938, **27**, 134-151 ; **28**, 1-8 ; 43-54 ; 76-87. A study of raphia production in Madagascar with notes on raphia oil and wax.

El Problema de la Producción de Seda en Cuba. By M. Tirelli. *Rev. Agric., Habana*, 1938, **21**, No. 11, 33-56. Discusses the possibilities for silk production in Cuba.

Sisal and Flax Production in East Africa. By W. H. Gibson. *J. Roy. Soc. Arts*, 1939, **87**, 204-221.

Sisal Hemp Textiles. A new Kenya Industry. Sisal Bags for Kenya Coffee Exports. *Mon. Bull. Coffee Brd. Kenya*, 1939, **5**, 10-11. Notes on the new industry started at Ruiru by Sisal Products (E.A.) Ltd.

L'Utilisation des Déchets de Sisal. By A. Hacquart. *Bull. Agric. Congo Belge*, 1938, **29**, 703-720.

Wool Growth and Quality as Affected by certain Nutritional and Climatic Factors. By J. E. Bowstead and P. Larose. *Canad. J. Res.*, 1938, **16**, (Sec. D), 361-374.

Waterproofing, Rotproofing and Fireproofing Fabrics. By L. Ivanovszky. *Mfg. Chem.*, 1939, **10**, 77-81, 96.

Tobacco

Harvesting and Curing of Tobacco Leaf. By A. Sharp. *J. Dep. Agric. W. Aust.*, 1938, **15**, 463-473.

Production of Virginia Tobacco in the Union of South Africa. By L. J. Henning, D. F. Retief, C. F. van Rooyen, A. J. Smith and A. F. Hean. *Bull. No.* 188, *Dep. Agric. Un. S. Afr.* Pp. 50, 9 × 6. (Pretoria : Government Printer, 1938.) Price 6*d*.

Studies on the Salt Requirement of Tobacco. By F. de Peralta and D. B. Paguirigan. *Philipp. J. Agric.*, 1938, **9**, 253-270.

The " Gundry " Tobacco Furnace. By B. G. Gundry. *Rhod. Agric. J.*, 1939, **36**, 31-38.

Marketing of Indian Tobacco. By T. M. R. Chari. *Emp. Producer*, 1939, No. 261, 26-29.

Diseases of Tobacco in Southern Rhodesia. By J. C. F. Hopkins. *Rhod. Agric. J.*, 1939, **8**, 45-60.

Some Studies on Tobacco Diseases in Ceylon. V. The Use of Fungicides in the Control of Damping-off of Tobacco Seedlings. By W. R. C. Paul and M. Fernando. *Trop. Agric., Ceylon*, 1938, **91**, 338-344.

Blue Mold (Downy Mildew) Disease of Tobacco. By E. E. Clayton and others. *Frms.' Bull. No.* 1799 (*Revised*), *U.S. Dep. Agric.* Pp. 20, 9 × 6. (Washington, D.C. : Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

The Spraying of Tobacco Seed Beds and Control of Rosette Disease. By J. C. F. Hopkins and M. C. Mossop. *Rhod. Agric. J.*, 1938, **35**, 760-764.

Drugs

The Production of Cape Aloes. By J. H. Farrer and G. E. Trease. *Pharm. J.*, 1939, **142**, 249.

Administration Report of the Madras Government Cinchona Department for the year 1937-38. Pp. 16, 13 × 8½. (Madras : Superintendent, Government Press, 1938.)

Trade in Indian Ephedras. By T. P. Ghose. *J. Indian Chem. Soc., Industr. and News Ed.*, 1938, **1**, 142-145.

Miscellaneous Agricultural Products

The Chemical Constitution of Agar-Agar. By E. G. V. Percival. *Pharm. J.*, 1939, **142**, 189.

Report on the Fermentation Industries for 1938. Prepared for the Society of Chemical Industry and the Institute of Brewing. By R. H. Hopkins, F. W. Norris and I. A. Preece. Pp. 32, 9¾ × 7½. (London: Institute of Brewing, 1939.)

Fermentation Processes. By P. A. Wells and G. E. Ward. *Industr. Engng. Chem., Industr., Ed.*, 1939, **31**, 172-177.

Power Alcohol in Other Countries. By C. N. Acharya. *Madras Agric. J.*, 1939, **27**, 3-9.

Alcohol from Farm Products. By P. B. Jacobs. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 162-165.

Motor Fuels from Farm Products. By P. B. Jacobs and H. P. Newton. *Misc. Publ. No.* 327, *U.S. Dep. Agric.* Pp. 129, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 15 cents.

Manufacture of Industrial Alcohol in Ireland. By J. Cormack. *Comm. Int. J., Canada*, 1939, **60**, 116-118.

Plastic Materials from Farm Products. By G. H. Brother. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 145-148.

Livestock and Animal Products

Report of the Veterinary Director General, Department of Agriculture, Canada, for the year ended March 31, 1938. Pp. 45, 9¾ × 6½. (Ottawa: King's Printer, 1938.)

Report of the Chief of the Bureau of Animal Industry, United States Department of Agriculture, for 1938. Pp. 85, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.). Price 10 cents.

Dairy Cattle Breeds. By A. B. Nystrom. *Frms.' Bull. No.* 1443 (*Revised*), *U.S. Dep. Agric.* Pp. 34, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Casein. A Summary of Some of the More Important Developments Published Concerning this New Textile Material. *Silk and Rayon*, 1939, **13**, 254-256.

Sheep and Goat Management. By L. G. Frangos. *Cyprus Agric. J.*, 1938, **33**, 116-119.

The Lamb Raising Industry. By J. M. Coleman. *J. Dep. Agric. S. Aust.*, 1939, **42**, 531-557. A survey of the position and potentialities of the industry made for the Australian Meat Board.

The Merino and Its Environment. By J. J. J. Kotzé. *Frmg. S. Afr.*, 1939, **14**, 47-48, 68.

Goat Husbandry in Canada. By A. A. MacMillan. *Publ. No.* 634, *Dep. Agric. Canada.* Pp. 16, 9¾ × 6½. (Ottawa: Department of Agriculture, 1938.)

Pig Raising. *Queensld. Agric. J.*, 1939, **51**, 43-88. An authoritative article dealing fully with the subject. Prepared by the officers of the Pig Raising Branch, Department of Agriculture, Queensland.

Bee-keeping for Beginners. By C. Drieberg and St. L. H. de Zylva. *Bull. No.* 92, *Dep. Agric. Ceylon.* Pp. 18 + 5 plates, 9¾ × 6. (Peradeniya: Propaganda Officer, Department of Agriculture, 1938.) Price 40 cents.

Bee-keeping—The Management of a Modern Apiary. By A. W. Kannangara. *Trop. Agric., Ceylon*, 1939, **92**, 94-99.

The Removal of Undesirable Flavour and Colour from New Zealand Honey. By R. H. K. Thomson. *N.Z. J. Sci. Tech.*, 1939, **20**, 220B-227B.

Protecting Bee-combs from Wax-moth. Precautionary Measures Described. By T. S. Winter. *N.Z. J. Agric.*, 1938, **57**, 527-528.

FORESTRY

General

A Forestry Tour in 1937. By L. Chalk. *Pap. No.* 16, *Imp. For. Inst. Oxford.* Pp. 71, 9½ × 6. (Oxford : Imperial Forestry Institute, 1939.) Price 2*s.* 6*d.* Describes a tour which included visits to the U.S.A., British Honduras, Canada, Hawaii, Fiji, New Zealand, Eastern Australia, Java, Malaya, Burma, India and Ceylon.

Report of the Director of Forests, Queensland, for the year 1937-38. Pp. 48, 13 × 8. (Brisbane : Government Printer, 1938.)

Annual Report of the Woods and Forests Department, South Australia, for the year ended June 30, 1938. Pp. 16, 13 × 8. (Adelaide : Government Printer, 1938.)

Report on the Forest Department, British Guiana, for 1937. Pp. 9, 13 × 8. (Georgetown, Demerara : "The Argosy" Company, Ltd., 1939.)

Report on Forest Administration in the Utilisation Circle, Burma, for the year ended March 31, 1938. Pp. 43, 9¾ × 6½. (Rangoon : Superintendent, Government Printing and Stationery, 1939.) Price Rs. 2.

Report of the Lands, Parks and Forests Branch of the Department of Mines and Resources, Canada, for the year ended March 31, 1938. Pp. 83, 9¾ × 6½. (Ottawa : King's Printer, 1939.)

The Forests of New Brunswick. By M. B. Morison. *Bull. No.* 91, *For. Serv. Canada.* Pp. 112, 9¾ × 6½. (Ottawa : King's Printer, 1938.)

Administration Report of the Conservator of Forests, Ceylon, for 1937. Pp. 17, 9½ × 6. (Colombo : Government Record Office, 1939.) Price 20 cents.

Check-Lists of the Forest Trees and Shrubs of the British Empire. No. 4. Draft of First Descriptive Check-list for Ceylon. By L. A. J. Abeyesundere and R. A. de Rosayro. Pp. 115, 9½ × 8. (Oxford : Imperial Forestry Institute, 1939.) Mimeographed.

Forest Research in India, 1937-38. Part I. The Forest Research Institute. Pp. 98, 9½ × 6½. (Delhi : Manager of Publications, 1938.) Price Rs. 2 As. 4.

Progress Report of the Forest Administration, Assam, for the year 1937-38. Pp. 53, 13 × 8. (Shillong, Assam : Government Press, 1938.) Price Re. 1 As. 14.

Report on Forest Administration in the Province of Orissa for the year 1937-38. Pp. 94, 10 × 7. (Cuttack, Orissa : Government Press, 1939.) Price Rs. 2 As. 10.

Annual Report of Forest Administration in the United Provinces, India, for the year ending March 31, 1937. Pp. 78, 9½ × 6½. (Allahabad : Superintendent, Printing and Stationery, 1938.) Price As. 10.

L'Indochine Forestière. By P. Maurand. *Bull. Écon. Indochine*, 1938, **41**, 801-829 ; 975-1061 ; 1350-1366. A report submitted to the 7th International Congress on Tropical and Sub-tropical Agriculture, Paris, 1937. A study of the forests of Indo-China and their management. Gives classified account of the timbers produced with particulars of their uses and includes a chapter on minor forest products.

Annual Report of the Forest Department, Mauritius, for 1937. Pp. 21, 9½ × 6. (Port Louis : Government Printer, 1938.)

Annual Report on the Forest Administration of Nigeria for 1937. Pp. 46, 13 × 8. (Lagos : Government Printer, 1939.) Price 4*s.*

Annual Report of the Director of Forestry of the Philippines for the year 1937. Pp. 339, 9 × 6. (Manila : Bureau of Printing, 1938.)

Annual Report of the Division of Forestry, Department of Agriculture and Forestry, Union of South Africa, for the year ended

March 31, 1938. Pp. 70, 13 × 8. (Pretoria: Government Printer, 1938.) Price 2*s*.

Utilisation of Forest Wealth. Forests.—Their Influence and Their Rôle in the Economic Reconstruction of the Country. By Rao Sahib S. Rangaswami. *Indian For.*, 1939, **65**, 74-86.

Timber

The Wood Anatomy of Some Australian Meliaceae with Methods for their Identification. By H. E. Dadswell and D. J. Ellis. *Bull. No.* 124, *Coun. Sci. Industr. Res. Aust.* Pp. 20 + 6 plates, 9½ × 6. (Melbourne: Government Printer, 1939.)

British Colonial Timbers. Woods Recommended for Various Uses. Pp. 11, 8 × 6½. (London: Colonial Forest Resources Development Department, 1939.)

Eigenschaften und Verwendung einiger Ostafrikanischer Hölzer. By L. Vorreiter. *Tropenpflanzer*, 1939, **42**, 148-156. Characteristics and uses of some fifteen woods from East Africa.

Official List of Trade Names of Indian Timbers (Revised 3rd Edition.) *Indian For. Rec.* (*New Ser.*) *Utilization*, **1**, No. 7. Pp. 21, 9½ × 7¼. (Delhi: Manager of Publications, 1938.) Price As. 8.

Philippine Woods. By L. J. Reyes. *Tech. Bull. No.* 7, *Dep. Agric. Philipp.* Pp. 536 + 88 plates, 9 × 6. (Manila: Bureau of Printing, 1938.) Gives detailed descriptions of some 264 important or noteworthy timber species of the Philippines illustrated with photomicrographs, also short accounts of additional species of minor importance.

Weights of Philippine Woods. *Philipp. J. For.*, 1938, **1**, 327-332. Compiled by the Division of Forest Studies and Research, Bureau of Forestry.

South African-grown Furniture Woods. By M. H. Scott. *J. S. Afr. Forest. Assoc.*, 1938, No. 1, 41-46.

Mechanical Tests on Small Clear Specimens of White Cypress Pine (*Callitris glauca*). By I. Langlands. *J. Coun. Sci. Industr. Res. Aust.*, 1939, **12**, 16-17.

Douglas Fir. Pp. 31, 9½ × 7. (London: British Columbia Timber Commissioner, 1939.) An account of the properties and uses of this timber.

The Strength of Eastern Canadian Spruce Timbers in Sizes Shipped to the United Kingdom. *Circ. No.* 54, *For. Serv., Canada.* Pp. 6, 9¾ × 6½. (Ottawa: King's Printer, 1938.)

The Mineral Constituents of Wood. Part I. The Hardness of Teak in Relation to its Mineral Constituents. By R. F. Bromley and E. A. Rudge. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 279-280.

Moisture Content Determination. By R. A. G. Knight. *Bull. No.* 14 (2nd Ed.), *For. Prod. Res.* Pp. 21, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 9*d*. Deals with moisture content of timber.

Les Bois et les Panneaux Contreplaqués dans la Construction Aéronautique Moderne. By J. Collardet. Pp. 8, 12 × 9¾. (Paris: Comité National des Bois Coloniaux, 1938.) Discusses the use of wood and plywood panels in modern aeroplane construction.

Les Principales Essences [des Bois] Utilisées dans la Construction et la Décoration. By J. Collardet. Pp. 7, 12 × 9¾. (Paris: Comité National des Bois Coloniaux, 1938.)

The Preservation of Timber Against the Attacks of the Powder Post Borer (*Lyctus brunneus* Stephens) by Impregnation with Boric Acid. By J. E. Cummins. *J. Coun. Sci. Industr. Res. Aust.*, 1939, **12**, 30-49.

Principal Decays of Softwoods used in Great Britain. By K. St. G. Cartwright and W. P. K. Findlay. *Publication of the Department of Scientific and Industrial Research.* Pp. 106 + 16 plates, 9½ × 6. (London : H.M. Stationery Office, 1938.) Price 2*s*. 6*d*.

Relative Resistance to Decay of American and Philippine Woods under Philippine Conditions. *Philipp. J. For.*, 1938, **1**, 301-325.

Gums and Resins

Nederlandsch-Indische Gomsoorten. By T. M. Meijer and D. R. Koolhaas. *Ind. Mercuur*, 1939, **62**, 109-111. An account of the various gums of the Netherlands East Indies.

L'Origine Botanique du Copal. By M. J. Louis. *Bull. Agric. Congo Belge*, 1938, **29**, 838-839.

La Gomme-laque de Madagascar. By R. Decary. *Rev. Bot. Appl.*, 1939, **19**, 198-201. Deals with the resinous lacquer of *Gascardia madagascariensis* found in Madagascar.

Tanning Materials

Su alcuni Concianti Vegetali dell'Africa Orientale Italiana. By U. Lubrano. *Boll. Staz. Sper. Pelli Mat. Concianti, Napoli*, 1939, **17**, 9-15. An account of some vegetable tanning materials of Italian East Africa.

Harar (*Terminalia chebula*) Cultivation in the Punjab. By R. S. Chopra. *Indian For.*, 1939, **65**, 126-129.

Evaluation of Tanning Materials. A Method for Estimating the Combining and Fixing Properties of Vegetable Tanning Materials in Practical Tanning. By T. I. Pound and F. H. Quinn. *J. Int. Soc. Leath. Chem.*, 1939, **23**, 94-105.

The Production of Tanning Extracts. *Industr. Chem. Chem. Manuf.*, 1939, **15**, 109-112. A description of the plant of Richard Hodgson and Sons, Ltd., at Beverley.

IMPERIAL INSTITUTE

CONSULTATIVE COMMITTEE ON INSECTICIDE MATERIALS OF VEGETABLE ORIGIN

QUARTERLY BIBLIOGRAPHY ON INSECTICIDE MATERIALS OF VEGETABLE ORIGIN, NO. 6

(January to March 1939)

Prepared in collaboration with the Imperial Institute of Entomology and the Department of Insecticides and Fungicides, Rothamsted Experimental Station.

GENERAL

Agricultural Insecticides. By J. T. Martin. *Manuf. Chem.*, 1939, **10**, No. 2, 41-46.

Agricultural Products as Insecticides. By R. C. Roark. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, No. 2, 168-171.

A Résumé of Insecticide Literature and Patents. By R. C. Roark. *Soap*, 1939, **15**, No. 1, 105, 107, 115.

Review of United States Patents relating to Pest Control. Vol. XI (1938), Nos. 11, 12, Vol. XII (1939), No. 1. By R. C. Roark. *Bur. Ent., U.S. Dep. Agric.*

Report of the Chief of the Bureau of Entomology and Plant Quarantine, United States Department of Agriculture, 1938.

List of Publications of the Division of Insecticide Investigations, Bureau of Entomology and Plant Quarantine, Washington, for the three months ending September 30, 1938, together with a list of U.S. Patents by members of the Division granted during the same period.

Advances in Entomology during 1938. By E. N. Woodbury. *Industr. Engng. Chem., News Ed.*, 1939, **17**, No. 1, 13-16. Includes notes on insecticides.

Microtechnique Method of Testing Oil Insecticides on Scale Insects. By R. H. Smith. *J. Econ. Ent.*, 1938, **31**, 632-633. Used also with oils having pyrethrum, rotenone and other toxic substances in them.

Insecticide Labelling. *Soap*, 1938, **14**, No. 12, 111, 113, 115, 131.

Animal Pests. By E. R. Speyer, W. H. Read and O. B. Orchard. *Rept. Exp. Res. Sta. Cheshunt*, 1937, **23**, 59-65. (*R.A.E.*, 1938, **26**, A, Pt. 12, 711-712). Sprays and dusts containing nicotine, derris, pyrethrum, and quassia tested.

Sanitation in Fur Farming. The use of disinfectants and insecticides in insect and disease control. By R. Law. *Soap*, 1939, **15**, No. 2, 93, 95, 117.

ALKALOID-CONTAINING MATERIALS

Tobacco Products, including Nicotine and Nicotine Derivatives

Tobacco Stems as a Useful Source of Nicotine for Insecticidal Purposes. By M. C. Cherian and M. S. Kylasam. *Madras Agric. J.*, 1939, **27**, No. 2, 55-58.

Fruit Tree Capsids. *Adv. Leafl. No.* 150, *Minist. Agric., Lond.* Pp. 4. Includes use of nicotine for control.

Bugs Attacking Fruit Trees. *Agric. Gaz., N.S.W.*, 1939, **50**, Pt. 1, 31. Use of nicotine dust against *Nysius vinitor* and *Dicyphus* sp.

The Control of Banana Rust Thrips. The Control of Rust. By N. E. H. Caldwell. *Queensld. Agric. J.*, 1938, **50**, Pt. 5, 576-584. Use of nicotine dusts.

Pests of the Grape Vine. By J. H. Smith. *Queensld. Agric. J.*, 1938, **50**, Pt. 6, 700-707. Includes note on the use of nicotine for controlling grape thrips (*Haplothrips froggatti*).

Control of the Poinsettia Root Aphid. By G. A. Bieberdorf and F. A. Fenton. *J. Econ. Ent.*, 1938, **31**, No. 6, 733-734. Use of nicotine.

The Spraying of Tobacco Seed Beds and Control of Rosette Disease. By J. C. F. Hopkins and M. C. Mossop. *Rhodesia Agric. J.*, 1938, **35**, No. 10, 760-764. Includes reference to the use of nicotine in sprays.

Sheep Disease Remedies. Nicotine and Bluestone Remedy. By P. D. Hutson. *Rhodesia Agric. J.*, 1938, **35**, No. 12, 927-928.

Exports of Manufactures of Tobacco from the United States, 1923-1938. *Tobacco Markets, U.S. Bur. Comm.*, 1939, **14**, No. 8, 91. Includes exports of nicotine and tobacco extract.

Exports of Nicotine Sulphate from the United States, by Countries. *Tobacco Markets, U.S. Dep. Comm.*, 1939, **14**, No. 8, 102. Gives quantities and values for 1937 and 1938.

Exports of Tobacco Extract from the United States, by Countries. *Tobacco Markets, U.S. Dep. Comm.*, 1939, **14**, No. 8, 103. Gives quantities and values for 1937 and 1938.

Others

The Action of Paipu (*Stemona tuberosa*) on Lice. *Chin. Med. J.*, 1938, **54**, No. 2, 151-158. (*R.A.E.*, 1939, **27**, B, 61).

Las Hojas del Tomate, Soberbio Insecticida. By J. E. Castaneda de Ranero. *Riv. Agric. Cuba*, 1938, **21**, No. 10, 48. An account of the use of an extract of tomato leaves for controlling aphids.

INSECTICIDE MATERIALS CONTAINING ROTENONE AND ALLIED SUBSTANCES

General

Divisional Reports of the Department of Agriculture, British Guiana for the year 1937. Includes very brief notes on the experimental work being carried out with rotenone-containing plants.

Native Plants [of U.S.A.] with Rotenone. By E. N. Woodbury. *Industr. Engng. Chem., News Ed.*, 1939, **17**, No. 1, 12.

La Roténone, ses Propriétés et ses Applications. By M. Bertaud-Rossi. *Ann. Musée Col., Marseille*, 1938, **46**, 5e Sér, 6e Vol., fasc. 2.

Rotenone Determination. By H. A. Jones. *Soap Blue Book*, 1939, 190-191.

Le Dosage Chimique des Poudres Roténonées. By H. Bégué. *Ann. Agron.*, 1939, **9**, No. 1, 121.

The Relative Insecticidal Effectiveness of some Dusts containing Rotenone. *J. Econ. Ent.*, 1938, **31**, No. 6, 700-703. Comparison of the relative effectiveness of derris, cube and *Tephrosia virginiana* dusts against the cabbage worm (*Pieris rapæ*).

Derris

Het Insecticide *Derris elliptica*, Cultuur en Bereiding. By J. W. Zaaijer. *Bergcultures*, 1939, **13**, No. 4, 116-127.

Formosa Derris Plantations. *Chem. and Drug.*, 1938, **129**, No. 3073, 721.

Derris Root Becoming Important Crop—Taiwan (Formosa). *World Trade Notes. U.S. Dep. Comm.*, 1938, **12**, No. 53, 909.

Annual Report of the Department of Agriculture, Tanganyika Territory, 1937. Pt. 2. Includes on p. 35 a brief note of the position of derris cultivation in Tanganyika.

Derris Planting Material Exports Prohibited—Netherlands Indies. *World Trade Notes, U.S. Bur. Comm.*, 1939, **13**, No. 7, 105.

Insecticide Analysis. The determination of pyrethrins in pyrethrum products, and of rotenone in derris and cube. By J. J. T. Graham. *Soap*, 1939, **15**, No. 2, 97, 99, 101, 109. Review of recent work.

The Precursor of Buckley's Compound. By S. H. Harper. *Chem. and Indust.*, 1939, **58**, No. 13, 292.

Crystalline Solvates of Inactive Deguelin. By L. D. Goodhue and H. L. Haller. *J. Amer. Chem. Soc.*, 1939, **61**, No. 2, 486-488.

Kort Verslag van een Proef over Bestrijding van Helopeltis in Cacao door middel van Verstuiven (Report on the control of Helopeltis on cacao by dusting with derris powder). By J. G. Betrem. *Bergcultures*, 1938, **12**, No. 52, 1790-1796.

Observations on Control of Cankerworm by Sprays. By E. I. McDaniel. *Quart. Bull. Mich. Agric. Exp. Sta.*, 1938, **21**, No. 1, 32-34. (*R.A.E.*, 1939, **27**, A, Pt. 1, 28). Use of derris.

Measures for Control of Coconut Tree Hopper (*Sexava* spp.). By J. L. Froggatt. *N. Guinea Agric. J.*, 1938, **4**, No. 3, 3-6. Includes brief note of experiment with derris.

Life History and Control of the Cowpea Curculio. By F. S. Arant. *Exp. Sta. Rec.*, 1938, **80**, No. 1, 80. Abstract of *Bull.* 246, *Alabama Exp. Sta.*, 1938. Includes tests with derris.

Derris tegen Thrips in Vlas (Derris against thrips on flax). By W. Spoon. *Indische Mercuur*, 1939, **62**, No. 8, 95-96, and *Bergcultures*, 1939, **13**, No. 8, 244-246.

The Pear Slug (*Caliroa limacina*). By J. W. Evans. *Tasm. J. Agric.*, 1938, **9**, No. 3, 130-131. Control on hawthorn by derris dusts.

Some Observations on the Life History, Habits, and Control of the

Rice Caseworm (*Nymphula depunctalis* Guen.). By P. Sison. *Philipp. J. Agric.*, 1938, **6**, No. 3, 273-299. Includes notes on laboratory tests with derris powder.

Laboratory Tests with Insecticides against the Vegetable Weevil (*Listroderes obliquus*). By K. L. Cockerham and O. T. Deen. *J. Econ. Ent.*, 1938, **31**, No. 6, 695-697. Includes tests with derris.

The Scrub Tick. *Queensld. Agric. J.*, 1939, **51**, Pt. 1, 97. Note on the protection of dogs against scrub or bottle tick by treatment with derris.

Eenige Opmerkingen over den Afleveringsvorm van Derriswortel. (Some observations on the form in which derris is marketed.) By W. Spoon. *Ber. No.* 133 (1939), *Afdeel. Handelsmus. Kon. Ver. Kol. Inst., Amsterdam.*

The Outlook for Malayan Derris in the United States of America. By C. D. V. Georgi. *Malay. Agric. J.*, 1939, **27**, No. 1, 3-14.

Derris Root Exports Reported—British Malaya. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 3, 37. Gives exports of the root for 1936, 1937, and 1938 with countries of destination.

Derris Root Exports Gaining—Netherlands Indies. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 52, 895.

Rotenone Imports Increased—United States. *World Trade Notes, U.S. Dep. Comm.*, 1938, **13**, No. 8, 124. Imports of derris and lonchocarpus for 1936, 1937, and 1938.

Lonchocarpus

Some Lonchocarpus species, Rotenone Yielding Plants of South America. I. Botany—Cultivation—Producing Countries. II. Chemistry and Technology. III. Uses. By J. Legros. *Inter. Rev. Agric.*, 1939, **30**, No. 1, 11T-29T; No. 2, 51T-61T.

Insecticide Analyses. The determination of pyrethrins in pyrethrum products, and of rotenone in derris and cube. By J. J. T. Graham. *Soap*, 1939, **15**, No. 2, 97, 99, 101, 109. Review of recent work.

Observations on Control of Cankerworm by Sprays. By E. I. McDaniel. *Quart. Bull. Mich. Agric. Exp. Sta.*, 1938, **21**, No. 1, 32-34. (*R. A.E.*, 1939, **27**, A, Pt. 1, 28). Use of cube.

The Treatment of Mange in Animals by means of Timbo. By J. R. Meyer. *O. Biologico*, 1938, **4**, No. 8, 257-261. (*R. A.E.*, 1939, **27**, B, Pt. 3, 41).

A Study of the Decrease in Effectiveness of Cube when exposed to weathering. By C. B. Wisecup and L. B. Reed. *J. Econ. Ent.*, 1938, **31**, No. 6, 690-695.

Brazilian Barbasco Root Exports. *Chem. and Drug.*, 1939, **130**, No. 3086, 391. Gives figures of exports for 1937.

Rotenone Imports Increased—United States. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 8, 124. Imports of derris and lonchocarpus for 1936, 1937, and 1938.

Others

Devil's Shoestring, a Possible Commercial Source of Rotenone. Report of the Chief of the Bureau of Plant Industry, United States Department of Agriculture, 1938, p. 7. Note on superior strains of *Tephrosia virginiana* found with toxicity approaching commercial derris.

PYRETHRIN-CONTAINING MATERIALS

Pyrethrum. *Cyprus Agric. J.*, 1938, **33**, Pt. 4, 124-125. Note on experimental work in Cyprus.

Japanese Pyrethrum Industry. *Chem. and Drug.*, 1938, **129**, No. 3073, 721.

Pyrethrum Acreage Increased—Japan. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 6, 91.

Annual Report of the Department of Agriculture, Kenya, 1937. Vol. I. Includes notes on pp. 39-41 dealing with work on pyrethrum.

Seventh Agricultural Census (European Areas), Kenya, February 1938. Includes a table giving areas under pyrethrum in the various districts, together with production.

A European Smallholding. *E. Afr. Agric. J.*, 1939, **4**, No. 4, 244-248. Includes particulars of the cost of producing pyrethrum on a small farm in Kenya.

Pyrethrum Cultivation Planned—Netherland Indies. *World Trade Notes, U.S. Dep. Comm.*, 1938, **12**, No. 51, 883.

El Piretro, su Cultivo y Posibilidades en el Pais. By J. A. Campo. *Circ. No.* 44, *Min. Fom., Dir. Agric., Peru.*

Manurial Requirements of Pyrethrum (*Chrysanthemum cinerariifolium*). By J. T. Martin, H. H. Mann and F. Tattersfield. *Ann. Appl. Biol.*, 1939, **26**, No. 1, 14-24.

Insecticide Analysis. The determination of pyrethrins in pyrethrum products, and of rotenone in derris and cube. By J. J. T. Graham. *Soap*, 1939, **15**, No. 2, 97, 99, 101, 109. Review of recent work.

Peet-Grady Method. Official Method of the National Association of Insecticide and Disinfectant Manufacturers for Evaluating Liquid Household Insecticides. *Soap Blue Book*, 1939, 177-181.

The Small Group Peet-Grady Method. *Soap Blue Book*, 1939, 181-183.

Gnadinger-Corl Method for Evaluation of Pyrethrum Flowers. *Soap Blue Book*, 1939, 187-188.

The Seil Method for Estimation of Pyrethrins. *Soap Blue Book*, 1939, 184-186.

Wilcoxon-Holaday Method for Determination of Pyrethrin I. *Soap Blue Book*, 1939, 189.

Colorimetric Determinations of Pyrethrin I. Analysis of perfumed extracts of pyrethrum. By G. Canneri and G. Mannelli. *Brit. Chem. Abstr.*, 1938, B, March, 324. Abstract of paper in *Ann. Chim. Appl.*, 1938, **28**, 432-440.

Measures for Control of Coconut Tree Hopper (*Sexava* spp.). By J. L. Froggatt. *N. Guinea Agric. J.*, 1938, **4**, No. 3, 3-6. Includes brief note of experiments with pyrethrum.

Life History and Control of the Cowpea Curculio By F. S. Arant. *Exp. Sta. Rec.*, 1938, **80**, No. 1, 80. Abstract of *Bull.* 246, *Alabama Exp. Sta.*, 1938. Includes tests with pyrethrum.

Observations on Control of Cankerworm by Sprays. By E. I. McDaniel. *Quart. Bull. Mich. Agric. Exp. Sta.*, 1938, **21**, No. 1, 32-34. (*R.A.E.*, 1939, **27**, A, Pt. 1, 28). Use of pyrethrum.

Bugs Attacking Fruit Trees. *Agric. Gaz., N.S.W.*, 1939, **50**, Pt. 1, 31. Use of pyrethrum dust against *Nysius vinitor* and *Dicyphus* sp.

Pyrethrum and Leafhopper Dusting. By C. A. Doehlert. *Exp. Sta. Rec.*, 1939, **80**, No. 2, 229. Abstract of report in *Proc. Ann. Mtg. Amer. Cranberry Growers' Assoc.*, 1938.

Laboratory Tests with Insecticides against the Vegetable Weevil (*Listroderes obliquus*). By K. L. Cockerham and O. T. Deen. *J. Econ. Ent.*, 1938, **31**, No. 6, 695-697. Includes tests with pyrethrum.

An Effective Repellent for Biting Insects. By C. G. Macnay. *Canad. Ent.*, 1938, **70**, No. 8, 175-176. (*R.A.E.*, 1939, **27**, B, Pt. 1, 14). Pyrethrum extract.

The Pyrethrin Content of Home-made Fly Sprays. By S. I. Gertler and H. L. Haller. *Soap*, 1939, **15**, No. 1, 93-94.

Stock Sprays. Some Comments and Conclusions. By E. M. Searls and F. M. Snyder. *Soap*, 1939, **15**, No. 3, 99, 101, 111, 113.

Resistance of *Stomoxys calcitrans* to Laboratory application of Pyrethrum Spray. By C. Eagleson. *J. Econ. Ent.*, 1938, **31**, No. 6, 778.

Extracts from the Minutes of a Meeting of the Malaria Advisory Board, F.M.S., held on Friday, August 12, 1938. *Planter, Malaya*, 1938, **19**, No. 11, 568. Includes brief note on tests with oils containing pyrethrins against mosquitoes.

La Destruction Automatique des Moustiques dans les Aéronefs et le Vecteur de la Fièvre Jaune dans les Traversées Aériennes en Afrique. By G. A. P. Ross. *Bull. Off. Int. Hyg. Publ.*, 1938, **30**, No. 9, 2002-2031. (*R.A.E.*, 1939, **27**, B, Pt. 3, 48). Use of pyrethrum sprays.

Fleas as Domestic Pests. *Agric. Gaz. N.S.W.*, 1939, **50**, Pt. 1, 33-34. Use of pyrethrum.

Pyrethrum Imports Reviewed—United States. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 10, 157. Gives imports with countries of origin for 1936, 1937, and 1938.

OTHER INSECTICIDE MATERIALS OF VEGETABLE ORIGIN

Nouvel Insecticide Végétal. By I. V. Pylnov. *Chim. et Indust.*, 1938, **40**, No. 5, 998. Brief abstract of a paper in *Sov. Subtropki*, 1938, No. 1, 83-87, dealing with the use of an extract of the bulbs of *Cyclamen elegans*, said to contain saponin.

Ulteriori Ricerche sul valore Insetticida dell'Infuso di Legno Quassio. (Further investigations on the insecticidal value of quassia infusion). By F. Dotti. *Riv. Fruttic.*, 1938, **2**, No. 1.

L'Huile d'Olive comme Insecticide. By F. G. Regueral. *Fruits and Prim. Afr. N.*, 1938, **8**, No. 89, 245-247. (*R.A.E.*, 1939, **27**, A, Pt. 1, 6.)

Dinitro-o-cyclohexylphenol in the Control of the Citrus Red Mite. *J. Econ. Ent.*, 1938, **31**, 781-2. Walnut shell flour and redwood bark flour used as diluents.

NOTE.—The reference in brackets—*R. A.E.*, etc.—which appears after certain items of the bibliography indicates the part and page of the *Review of Applied Entomology* in which an abstract of the publication mentioned can be found.

BOOK REVIEWS

Books for review should be addressed to "The Editor," Bulletin of the Imperial Institute, South Kensington, London, S.W.7.

MANUAL OF INDIAN SILVICULTURE. Part I. General Silviculture. By H. G. Champion, M.A. Part II. Silvicultural Systems. By Sir Gerald Trevor, C.I.E. Pp. xiv + 374, $9\frac{3}{4} \times 7\frac{1}{4}$. (London: Humphrey Milford, Oxford University Press, 1938.) Price 30*s*.

There has long been the need for an authoritative, up-to-date treatise on Indian silviculture, and the authors of the present work are well qualified for their task. Mr. Champion has for ten years been silviculturist at the Forest Research Institute, Dehra Dun and Sir Gerald Trevor is Inspector-General of Forests to the Government of India. The forests of India comprise such a vast range of types and conditions that a special technique of silviculture has had to be built up

by the foresters and the object of this manual is to record the immense improvements in scientific forestry which have been made during the past thirty years.

Mr. Champion's section of the book, which occupies 280 pages, is concerned with the underlying principles of silviculture. He discusses these questions under the following headings: the locality factors of the forest (climatic and soil conditions); growth and form of trees and crops; tree and crop physiology; forest composition and distribution; natural regeneration; artificial regeneration; afforestation; and tending. In the second part, Sir Gerald Trevor describes the various silvicultural systems as applied to Indian forestry, following the arrangement in Troup's *Silvicultural Systems*. In his preface he modestly speaks of it as a compilation, but it is far more than this, for much that he has written is derived from his own personal experience or knowledge of the forests of India, acquired during his service of over thirty years.

The book is fully illustrated by diagrams and photographs and the general production is excellent. In the latter connection it may be of interest to mention that although published by the Oxford University Press, the book has been printed at the Baptist Mission Press in Calcutta.

COTTON. History, Species, Varieties, Morphology, Breeding, Culture, Diseases, Marketing and Uses. By Harry Bates Brown, A.M., Ph.D. Second Edition. Pp. xiii + 592, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1938.) Price 30*s*.

The scope of this work is well indicated by the sub-title and comparatively little space is devoted to the position of the industry in the various cotton-growing countries of the world. It is, therefore, essentially a book for the practical man who wishes to know all the fundamental facts about the cotton plant, its climatic requirements, breeding, cultivation, preparation, and marketing. It is eleven years since the book first appeared and the incorporation of the results of the vast amount of cotton research work carried out during this period has necessitated the rewriting of most of the chapters and the addition of 75 pages to the text. Although based primarily on American practice, everyone concerned in the production of cotton, in whatever part of the world he may be situated, will find it of very considerable service.

DISEASES OF FRUITS AND HOPS. By H. Wormald, D.Sc., A.R.C.S., D.I.C. Pp. 290, 8½ × 5½. (London: Crosby Lockwood & Son, Ltd., 1939.) Price 17*s*. 6*d*.

This book, by the Plant Pathologist and Assistant Director, East Malling Research Station, is complementary to Massee's *The Pests of Fruits and Hops* (see this BULLETIN, 1937, **35**,

553) and like that work is one of the series of Agricultural and Horticultural Handbooks issued under the general editorship of H. C. Long. Its primary object is to enable the grower to recognise the various disorders (physiological, fungal, bacterial, or virus) that affect his fruit and hops and to provide information that will help him to control them. More stress is therefore laid on the symptoms of the diseases than on the organisms causing them, although for the benefit of students and advisers in horticulture certain details are given which will enable the field diagnoses to be confirmed if necessary by microscopical means. After the description of each disease selected references are given where further details can be obtained. As in the case of Massee's book the photographic illustrations are especially fine.

After introductory chapters dealing respectively with factors conducive to health and disease in plants and with fungicides and their applications, there follow the accounts of the different diseases, commencing with those that affect a number of host plants and passing on to those of the individual fruits. These include the apple, pear, quince and medlar, the stone fruits, the various soft fruits, grape vine, fig, walnut and cob nut and finally the hop. There are three indexes devoted to popular names and control measures, scientific names and names of authors.

As Dr. Pethybridge says in his foreword, the book fills a very definite gap in horticultural literature and it can be thoroughly recommended to all growers of fruit, whether on a large or small scale.

The Chemical Analysis of Foods and Food Products. By Morris B. Jacobs, Ph.D. Pp. xxii + 537, 9 × 6. (London: Macmillan & Co., Ltd., 1938.) Price 25*s*.

This volume is an attempt to deal with the physical and chemical examination of human foods and food products in a concise, practical and essentially up-to-date way.

The earlier chapters of the book are devoted to general and physical chemical methods of examination, colouring matters and preservatives in food, and the detection and estimation of the various metals which may occur in foodstuffs, special prominence being given to lead. Then follow chapters dealing with the various classes of food materials, such as milk and milk products; oils and fats; sugars; gums and starches; jams, jellies and fruits; spices and condiments; beverages, both alcoholic and non-alcoholic; and meat, fish and eggs. Modern methods of estimating the various constituents are given in detail apart from the general methods given in the earlier chapters. A chapter on vitamins is of interest to those concerned in the present day evaluation of foodstuffs, and includes methods of detection of the better-known vitamins

and, where possible, methods of the assay of the vitamins in question are given. There is also a chapter on methods of estimating certain inorganic constituents of foodstuffs, including fluorine, selenium and iodine, as well as the commoner ones.

References to specific papers on methods of analysis are given as footnotes and lists of more general treatises are given at the close of each chapter.

The usual tables associated with this type of analysis are given in an appendix and include the well-known Munson-Walker Sugar Tables, the more recent Lane-Eynon table and others.

The author, who is a chemist attached to the Bureau of Food and Drugs of the New York Department of Health, has made a special feature of including details of methods not commonly dealt with in textbooks and mentions in particular in this connection such subjects as the detection of the improper pasteurisation of milk and chemical methods for the identification of vitamins. His book should prove a useful addition to the library of the chemist who is interested in foods and food products either from the standpoint of the manufacturer or that of the public or consulting analyst.

THE CHEMISTRY OF MILK. By W. L. Davies, Ph.D., D.Sc., F.I.C. Second Edition. Pp. xiv + 534, 8½ × 5½. (London: Chapman & Hall, Ltd., 1939.) Price 25*s*.

This book, which is the tenth of a series of monographs issued under the editorship of Dr. E. Howard Tripp with the purpose of focussing attention upon recent work or upon new aspects of old work was originally published in 1936. A notice relating to the first edition is to be found in this BULLETIN, 1936, **34**, 304. The fact that a new edition is called for within three years is sufficient testimony to the value of the book. The necessity for a new edition has been made more pressing on account of the rapid advances in dairy chemistry during the last three years. The author in writing this new edition has made no change in his method of presenting his subject but has worked into the text the newer knowledge that has become available. The sections of the book that have been most affected by the addition of further information are those dealing with the composition of milk, fat and fat oxidation, lactose, casein, mineral constituents, enzymes, physical chemistry and the nutritive value of milk.

BREWING SCIENCE AND PRACTICE. By H. Lloyd Hind, B.Sc., F.I.C., F.R.M.S. Volume I. Brewing Materials. Pp. xiv + 505, 9½ × 6¼. (London: Chapman & Hall, Ltd., 1938.) Price 50*s*. net.

This first volume of Lloyd Hind's book on Brewing is confined to a consideration of the materials used in the industry;

a second volume, still to be published, will deal with brewing processes. After an introductory chapter dealing with the historical side of the subject this first volume is divided into six main divisions devoted respectively to barley; the biochemistry of malt and wort; malt; sugars; hops; and water. Each division is sub-divided into chapters and these again into sections, which for convenience of reference are numbered. The four chapters devoted to barley include an account of its structure and classification; a description of the various malting barleys, together with a statement of the brewing requirements; its physiological characters with special reference to the essential qualities desired; a note on fungoid diseases and insect pests; its composition; the relation of nitrogen content to malting quality; its valuation as judged from its potential extract and nitrogen content. The biochemistry of malt and wort is discussed in three further chapters, under the headings of colloids and hydrogen ions; the carbohydrates and proteins of barley and malt; and enzymes. In the division devoted to malt the changes that take place during malting are described; commercial methods of analysis of malt are reviewed; typical malt analyses are given and the interpretation of the analytical results discussed. Special malts and unmalted cereals are also considered. Under the heading of hops are included chapters on their cultivation and treatment; their useful constituents; and the types of hops and their respective brewing values. The three chapters in the division on water deal with the character and classification of the water supplies used in various breweries; the influence of the composition of water on the character of beer; and methods of treating the water to render it more suitable for use in brewing.

The book is clearly printed and well arranged. It includes 63 figures, over half of which are plates, whilst 150 tables are inserted in the text. At the end of each chapter are given a summary of its contents and a list of references to literature cited therein. The book is furnished with name and subject indexes. This work should prove of great value to brewers, as well as to those engaged in the purely scientific side of brewing.

PROCESSES AND MACHINERY IN THE PLASTICS INDUSTRY. By Kurt Brandenburger. Pp. xii + 243, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: Sir Isaac Pitman & Sons, Ltd., 1938.) Price 25*s*.

Although other plastic or resinous materials are briefly touched upon, this book is chiefly concerned with phenolic resinoids and their compounds and with the moulds and presses necessary for the manufacture of articles of utility from them.

The book is in two parts, Part 1 (Chapters I to VII) dealing mainly with the raw materials, moulds and processes necessary

for the production of satisfactory products, whilst Part 2 (Chapters VIII to XV) is more concerned with the presses and other auxiliary machinery required.

In Chapter I the three classes of moulding processes are considered, the original, and now almost obsolete, cold moulding process in brief, and the hot moulding and injection moulding processes to a more considerable extent. Chapter II treats of the preparation of the material for moulding, and details of particular processes are given in Chapter III. The remaining chapters in this part are devoted chiefly to accessories and auxiliary apparatus and the heating of the moulds.

Various types of press and accessory equipment are dealt with comprehensively in Chapters VII to XII, whilst the organisation of the works to produce the highest output and special mouldings for particular purposes are considered in the next two chapters. In the last chapter the trend of future development is discussed.

The book is well illustrated and is furnished with a bibliography and index.

The work is a translation, very well carried out by H. I. Lewenz, M.I.Mech.E., with little or no evidence of the stilted style so frequently encountered in translations, of K. Brandenburger's *Herstellung und Verarbeitung von Kunstharz-Pressmassen*, First Edition, 1934, and cannot therefore be considered completely up to date. It has, however, been written by a thoroughly practical man and, although progress has been made since the German version was published, the present book should prove of much value to those connected with the plastics industry.

Sole Leather or Hides and Leather. By D. Laurence-Lord. Pp. xvii + 162, $7\frac{1}{4} \times 5$. (Southend-on-Sea: The Technical Book Co., 1938.) Price 5*s*.

This small book is designed to give the shoe maker and repairer a quick education in the manufacture of leather, in order that with the possession of such knowledge he will be able to purchase his leather requirements efficiently. To this end the structure and quality of hides, and the processes to which they are subjected in the tannery are briefly described. Then follows a discussion of sole leather, and the many features to be considered in relation to specific requirements of the shoe maker, a subject on which the author is obviously well at home. The question of cut soles or bends for cutting as stock is discussed at length, and so are the subjects of leather tempering, conditioning and compression. Throughout the book the point of view is that of the shoe repairer, and the aspects of sole leather which are of prime interest in his trade are always to the fore.

BOOKS RECEIVED FOR REVIEW

HANDBOOK OF FOOD MANUFACTURE. By Dr. F. Fiene and Saul Blumenthal, B.S. Pp. vi + 603, 9 × 6. (London: Chapman & Hall, Ltd., 1939.) Price 25*s*.

NUTRITION AND DIET THERAPY. By Fairfax T. Proudfit. Seventh Edition. Pp. viii + 923, 8½ × 5½. (New York: The Macmillan Company; London: Macmillan & Co., Ltd., 1938.) Price 14*s*.

THE PLANT ALKALOIDS. By Thomas Anderson Henry, D.Sc. Third Edition. Pp. viii + 689, 8½ × 5½. (London: J. & A. Churchill, Ltd., 1939.) Price 42*s*.

A TEXTBOOK OF PHARMACOGNOSY. By T. C. Denston, B.Pharm., A.I.C., Ph.C., F.L.S. Third Edition. Pp. xvi + 583, 8½ × 5½. (London: Sir Isaac Pitman & Sons, Ltd., 1939.) Price 20*s*.

THE MANUFACTURE OF PULP AND PAPER. Prepared under the Direction of the Joint Textbook Committee of the Paper Industry of the United States and Canada. Volume V. Papermaking Machines; Handmade Papers; Paper Finishing; Coated Papers; Paper Testing; Papermaking Details. Third Edition. Pp. xiii + 748, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 36*s*.

THE RAPE OF THE EARTH. A WORLD SURVEY OF SOIL EROSION. By G. V. Jacks and R. O. Whyte. Pp. 312, 8½ × 5½. (London: Faber & Faber, Ltd., 1939.) Price 21*s*.

WILD FLOWERS OF AUSTRALIA. By Thistle Y. Harris, B.Sc. Pp. xviii + 198, 8½ × 5½. (Sydney and London: Angus & Robertson, 1938.) Price 8*s*. 6*d*.

THE STRUCTURE OF ECONOMIC PLANTS. By Herman E. Hayward. Pp. x + 674, 9¼ × 6¼. (New York: The Macmillan Company; London: Macmillan & Co., Ltd., 1938.) Price 22*s*.

PRINCIPLES OF GENETICS. By Edmund W. Sinnott and L. C. Dunn. Third Edition. Pp. xiv + 408, 9 × 6. (London: McGraw-Hill Publishing Company, Ltd., 1939.) Price 21*s*.

ANIMAL ECOLOGY. By A. S. Pearse. Second Edition. Pp. xii + 642, 9 × 6. (London: McGraw-Hill Publishing Company, Ltd., 1939.) Price 30*s*.

PHOTOGRAPHY BY INFRARED. Its Principles and Applications. By Walter Clark, Ph.D., F.I.C., F.R.P.S. Pp. xi + 397, 9¼ × 6¼. (London: Chapman & Hall, Ltd., 1939.) Price 25*s*.

MINERAL RESOURCES

ARTICLES

MANGANESE AND GOLD DEPOSITS IN THE LOWER AND MIDDLE BARAMA RIVER OF NORTH-WEST DISTRICT, BRITISH GUIANA[1]

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Introduction

During the geological survey of the goldfields of the lower and middle Barama River, carried out by the writer in late 1937 and early 1938, several deposits of manganese were found. The following account presents a summary of the information now available on these deposits, together with notes on a few of the more promising gold occurrences which merit further investigation. A complete report on the district is in preparation; meanwhile geological and topographical maps of the area described are available for consultation in the Geological Survey Office, Georgetown.

The district is easily accessible by water transport, the journey from Georgetown taking between two and three days. There are no falls or rapids on the route, and freight rates are consequently low.

The analyses and gold assays quoted were carried out by Mr. K. Wallis, B.Sc., Government Analyst.

Geology

The Barama River, for the greater part of its lower and middle course, flows as a strike stream through a belt, some 10 miles wide, of metamorphosed acid to intermediate volcanic rocks which include some phyllites and occasional wide but lenticular beds of quartz-hornfels. The quartz-hornfels, and the agglomerates of the volcanic series, form the most easily recognisable horizons in an area where decomposition of the rocks is well advanced.

1 Forwarded on April 13, 1939 by the Commissioner of Lands and Mines, B. G., for publication in this Bulletin.

The strike of cleavage and schistosity in the rocks of the middle Barama is persistently 110° to 120° (magnetic) while in the lower Barama the predominant strike is from 60° to 70°. Dips vary steeply on either side of the vertical but are mainly northerly. The strike of individual formations is generally parallel to that of cleavage and schistosity.

The belt of volcanic and associated rocks is bounded on either side by wide areas of non-foliated hornblende-granite. Occasionally, as at Ianna and Yakishuru, small stocks of the same granite appear amongst the volcanic rocks. The gold mineralisation is closely related, in most cases, to the marginal phases of the granitic areas.

The manganiferous rocks are confined to a relatively narrow zone occupying a median position within the belt of volcanic rocks adjacent to the quartz-hornfels horizon. They occur both as massive outcrops of ore, and as decomposed schistose grey to black rocks of low manganese content which give rise to distinctive greenish-black soils. Manganiferous varieties of the quartz-hornfels also occur.

Manganese

The first indications of manganese were found in the neighbourhood of the old Tasawinni Mine, and the manganiferous zone was subsequently traced intermittently over a strike distance of about 2¾ miles and over a width of 1 mile. A further occurrence was noted in the Pipiani district, 17 miles to the south-west. The horizon here was traced further by the Director during a later survey.

Tasawinni District.—The largest deposit of manganese ore in this district, so far as is known at present, lies on the eastern slopes, near the summit of a strike ridge which attains an elevation of 250 ft. above the adjacent creek levels, immediately east of Tasawinni Mine. The deposit is traceable on the surface by outcropping ledges and boulders, some of which are estimated to weigh over 100 tons. The material is a hard, bluish-black rock (probably mainly psilomelane) with a specific gravity in bulk of 3·3. It is given a slightly porous appearance by discontinuous lines of parallel cavities in which small-scale botryoidal structures occur. Occasionally there are inclusions of ferruginous, kaolinitic, and quartzose material. The outcrops have a striated appearance, owing to the weathering out of the

parallel cavities and of softer bands, the partings having a strike and dip similar to that of the neighbouring non-manganiferous rocks (i.e. 50° to 60° with a dip of 80° to the north-west). The deposit as a whole has a strike of 52°. On the hanging wall side, the ore becomes obscured by yellow clays derived from the decomposed rocks of the ridge summit, while on the footwall there is an abrupt change to lateritic ironstone retaining the structure of a schistose rock.

The maximum width of the deposit, as indicated by pitting through shallow overburden and examination of outcrops, is in the neighbourhood of 500 ft. Its length, so far as can be determined by surface observation of outcrops and float fragments, is about half a mile.

Analysis of a bulk sample, obtained by blasting a representative outcrop in the wider section of the deposit, gave the following results: metallic manganese, 43·17 per cent.; iron, 2·74 per cent.; silica, 15·98 per cent.; phosphorus, 0·077 per cent. A picked sample of clean ore (sp. gr. 3·68) from the same exposure was found to contain an appreciably lower percentage of impurities, as follows: iron, 1·76 per cent.; silica, 4·08 per cent.; phosphorus, 0·018 per cent. Further analytical work is in progress.

Several other deposits were found in the district, but in each case the width appears to be small (50 ft. or less) and the tenor low. A narrow outcrop of ore occurs along the same strike as the main deposit, on a ridge about ½ mile to the north-east. A sample taken from the face of the outcrop contained 14·41 per cent. of manganese. Approximately ¼ mile south-east of the main deposit, manganiferous rocks outcrop along a ridge for a distance of about half a mile. A sample obtained by blasting a large exposure gave 21·82 per cent. of manganese. Near to and south-east of this locality, a separate deposit, outcropping on the eastern slope of a ridge, was sampled superficially and found to contain 20·34 per cent. of manganese.

Pipiani District.—Manganiferous rubble was noted on a flat-topped hill, at about 400 ft. elevation above sea-level, 2¼ miles east of Pipiani Shop Landing and 1½ miles north-east of the mouth of the Ianna River. The material covers a width, at right angles to the strike of the country rocks, of about 500 ft. A sample taken at random yielded 21·29 per cent. of manganese.

About 1½ miles to the north-east, along the same strike, the manganiferous horizon was examined by the Director, Geological Survey. Boulders and rubble of manganese ore cover a wide area here, and analyses of the samples obtained are being made.

Possibilities of Development.—The preliminary examination by the Geological Survey, the results of which have been given above, indicates that there are possibilities of a deposit of commercial grade in at least one locality, i.e. near Tasawinni Mine. A much more extensive examination will be necessary, however, before the quantity and grade of ore available can be assessed. The possibility must be borne in mind that the deposits may only represent shallow surface enrichments of low-grade manganiferous rocks. The continuity of the deposits in depth can only be ascertained by pitting, drilling, or preferably by adit tunnelling to which the topographical conditions in each deposit are well adapted.

Should ore of sufficient quantity and grade be proved to exist, conditions of cheap transportation will be necessary before exploitation can ensue. In this connection it may be pointed out that the Tasawinni deposit lies 3 miles from the Barama River some 20 miles from its confluence with the Waini River. The Waini is a wide and deep river probably capable of carrying ocean-going vessels, but a bar exists at its mouth which might prove an obstacle to navigation. The Barama River itself is tidal, and possibly navigable, in the lower 10 or 15 miles of its course.

Gold

Gold, in alluvial and eluvial deposits and in quartz reefs and shear-zones, is widespread in the lower and middle Barama. Attention is here drawn only to those deposits which, in the opinion of the writer, have immediate possibilities of development requiring underground exploration. These are the gold-quartz occurrences at Stonehill, Ianna, and at Ite Creek, lower Barama, and the mineralised shear-zone at Yakishuru.

Stonehill.—Examination of the surface and shallow underground workings on this property indicates the occurrence of two parallel quartz reefs, 50 ft. apart, striking north-east—south-west, and dipping at 40° to 60° to the south-east. The country rocks are sheared volcanic tuffs striking 120° and dipping at

$75°$ to the north-west; into these, about ¼ mile south-east of the workings, an auriferous granite stock, covering an area of some 2 sq. miles, is intruded.

The low hill on which the reefs outcrop and over which float quartz is widely scattered attains an elevation of 60 ft. above local water-level. At the time of the survey the northern reef was being worked above water-level from a 30 ft. shaft, the material from the workings, together with float quartz collected from shallow excavations, being treated in a small 2-stamp mill, crushing through 20-mesh screens.

The known length of strike of the reefs, as indicated by surface examination of outcrops and old workings, is in the neighbourhood of 1,000 ft. North-eastwards the zone is obscured by alluvium, while to the south-west no prospecting has been done.

Sampling of a drive along the northern reef, at water-level, gave an average value of 26·0 dwt. per ton over an average width of 8 in. for a length of 75 ft. The samples were taken at an average interval of 10 ft., more detailed sampling being prevented by the stoping out, to the old fill above, of small chambers along the drive. The individual values obtained are erratic, ranging from 2·4 to 62·8 dwt. per ton, while widths vary from 3 in. to 15 in. The average value of the quartz taken out of the drive was stated by the operator to be about 3 oz. per ton. A grab sample of tailings from the mill assayed 4 dwt. per ton.

An old 54 ft. shaft, now caved, sunk 300 ft. to the south-west, on the same reef, with a drive at water-level of about 50 ft., was stated to have given values of 3 oz. per ton over an average width of 2 ft. An exposure of the reef, near the old shaft, was sampled and assayed 6·4 dwt. per ton over a width of 15 in.

On the results of the examination further investigation of the property appears desirable. This should include further surface and adit exploration, followed by drilling or exploratory underground work below water-level.

Ite Creek.—At this locality in the lower Barama, half a mile inland from the river, a quartz reef is being worked on a low hill about 50 ft. above local water-level. The quartz is crushed by hand through 16-mesh screens and washed in a sluice for recovery of the gold by amalgamation. The average

tenor of the quartz milled was reported to be about $1\frac{3}{4}$ oz per ton.

The reef, striking 150° and dipping 30° to 40° to the south west (i.e. into the hill) occurs in decomposed sheared tuffs and manganiferous phyllites near an extensive outcrop of manganiferous quartz-hornfels. The strike of shearing in the country rocks is 70° and the dip 75° to the south-east. The reef has been exposed and worked discontinuously over a strike length of about 120 ft.

Visible coarse gold is frequently seen in the quartz, but its occurrence is erratic. Samples crushed and washed from the same locality gave widely varying results. Samples taken for assay at 5 ft. intervals along a 25 ft. exposure of the reef showed similar variation in gold content, but three of the serial samples, adjacent to each other, gave consistently high values averaging 27 dwt. per ton over an average width of 29 in. A grab sample from the tailings of the sluice assayed 2·8 dwt per ton.

The workings are proceeding at shallow depth along the strike of the reef, the circumstance of its dip into the hill making the work uneconomic under the present methods below a stripping depth of 15 ft. An examination of the deposit by further surface trenching and by adit work is recommended.

Yakishuru Hill.—The deposit presenting the greatest interest in this locality is a mineralised shear-zone, striking 120° with a northerly, steep to vertical dip, occurring in decomposed volcanic rocks, 150 ft. distant from and parallel to a small elongated granite stock which is itself auriferous. The deposit lies on the slopes of a low ridge at an elevation of 50 ft. above water-level, and has been worked in small open cuts by hand labour with the aid of a pump and puddling machine for extraction of the gold by amalgamation. The harder material, such as the quartz-stringers of the shear-zone, is periodically crushed by hand. Visible gold is common in the quartz.

Two excavations, 200 ft. apart, are being worked at present, while older workings in eluvial material occur along the same strike. The surface examination indicated a possible length for the deposit of 1,000 ft., with a maximum width of 40 ft. It has been worked to a depth of 30 ft., a further 20 ft. still remaining above water-level.

Sampling by battel-washing without crushing (in order to determine the values recoverable by the methods being employed) in the larger excavation gave an average value of $1.00 per cu. yd. over an average width of 21 ft and a depth of 30 ft. Assayed samples, however, gave much higher results, one giving a value of 11·6 dwt. per ton over a width of 11 ft., as compared with a battel valuation of $3.56 per cu. yd. over the same section. In the neighbouring opencut, work has been confined to a narrower zone in which values on assay of 48·4 dwt. over a width of 6 in. and 8·0 dwt. over a width of 24 in. were obtained.

While the hill as a whole deserves examination with a view to organised working of the eluvial deposits (there appears a possibility of some 500,000 cu. yds. of this material averaging 70 cents per cu. yd.), exploration of the shear-zone deposit is of major importance. An examination by trenching and adit work, followed, if this proves satisfactory, by work below water-level, is recommended.

THE GOLD MINING INDUSTRY IN NORTH-EAST NEW GUINEA

THE rapid development during recent years of the gold mining industry of North-east New Guinea is attributed in no small measure to the use of aeroplanes for the transport of machinery and other equipment over the mountainous and tropical country between the port of Lae and the actual dredging properties, which are situated high above sea-level. On June 30, 1938, there were on the Morobe field itself some 700 Europeans and 6,218 natives engaged in the mining industry, and, in view of the fact that a notable proportion of the natives were cannibals and living in the " Stone Age " about a generation ago, their progress is indeed remarkable. Apart from their use as police constables, they are now being employed as pump attendants and winch and lorry drivers.

North-east New Guinea occupies an area of about 70,000 sq. miles, and is divided into three Administrative Districts, viz., Sepik, Madang, and Morobe. Gold occurs in all these Districts, the most important deposits so far discovered being in the south-east of the country, in the District of Morobe,

which, up to the end of June 1938, has produced some 1,391,553 fine oz. of gold and 825,150 fine oz. of silver.

Morobe District consists almost entirely of steeply-sloping mountain ranges with the peaks reaching altitudes up to 14,000 ft. In the absence of roads from the coast, access by land to the interior is by native tracks which generally pass from village to village. Such routes are often circuitous; thus the journey along the Gadagadu track from Salamaua to Wau with native carriers takes from 8 to 10 days, although the places are only 34 miles apart. The track crosses a dozen mountain ridges ranging in height from 1,500 to 6,700 ft.

The important goldfield in the interior of Morobe District (*see* accompanying sketch map on p. 253) covers an area of 4,400 sq. miles. With the exception of certain portions, chiefly in the valleys of the larger streams where a tall coarse grass grows, the whole area is covered with dense tropical jungle. Geologically, the Morobe goldfield comprises a basement series of slates and schists (probably Palæozoic in age) that has been intruded by pre-Tertiary granite and granodiorite batholiths, and by smaller porphyritic bodies of Tertiary age. Both pre-Tertiary and Tertiary intrusives have introduced gold, for the most part in small lenses and stringers of quartz from which the gold has been freed by erosion and concentrated in the stream channels. All lode deposits of economic value as yet discovered have been associated with the younger Tertiary intrusives, which are localised in the Wau—Mt. Kaindi area. In general, the lodes occur in the slate series as mineralised shear zones in proximity to intrusive porphyry.

Reef gold from the older granitic intrusions has a fineness of 850 in the neighbourhood of the intrusions; the younger porphyries provide two grades of gold, one about 500, and the other between 700 and 800.

The chief gold-bearing rivers of the Morobe goldfield are the Bulolo and the Upper Watut which join to form the Watut River, which, in turn, joins the Markham River. There are numerous tributaries to each.

The discovery of gold in 1902 in the Yoda and Gira fields of the Territory of Papua, close to the Morobe boundary, drew the attention of Australian prospectors to the possible occurrence of gold in the adjoining part of Morobe, the result being that the metal was found in the Waria River area in 1906,

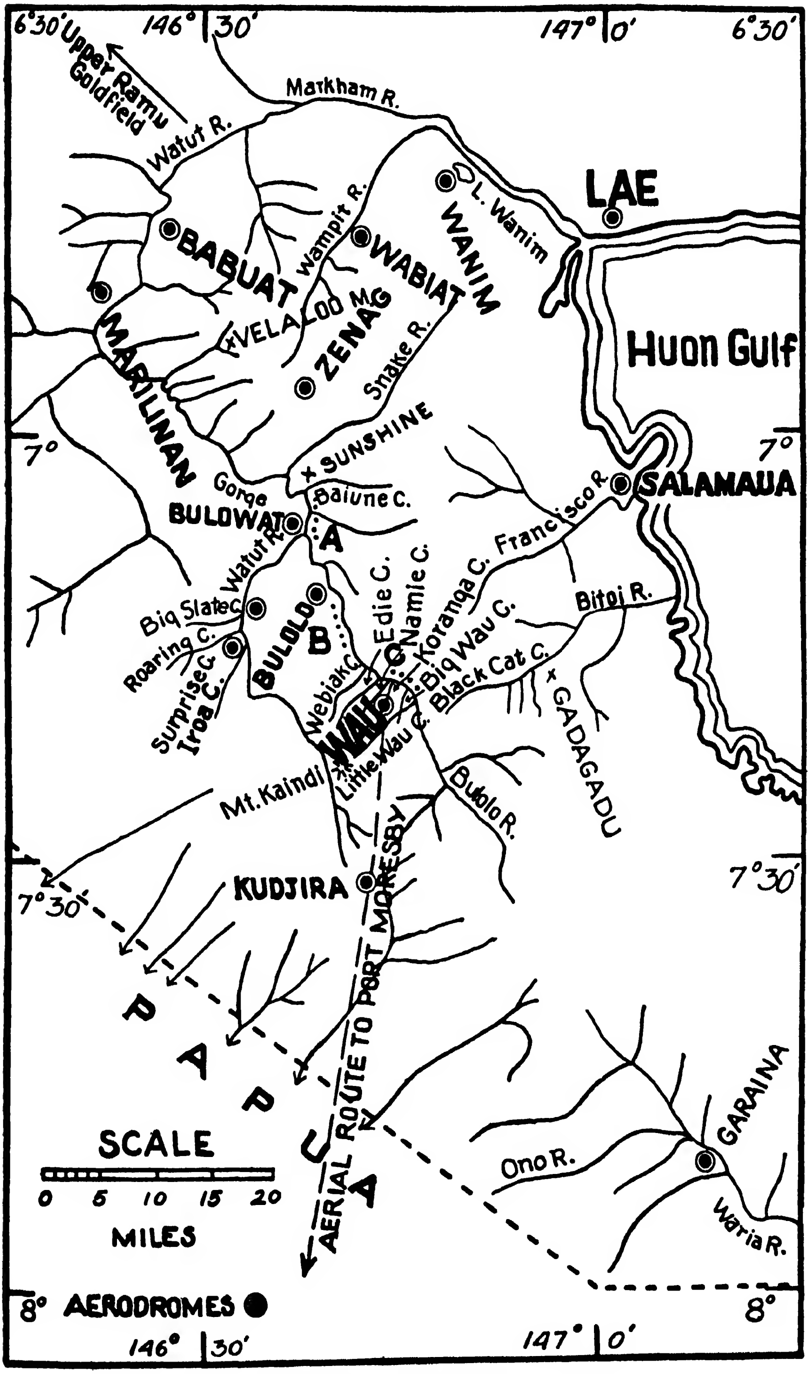


FIG. 1. SKETCH MAP OF MOROBE GOLDFIELD.

although in hardly payable amounts. Later, in 1914, it was estimated that the area contained 900 million cu. yds. of gravel which could be worked by hydraulic methods at a profit of about 4*d*. per cu. yd. After the Great War, however, several dredging leases in the area were considered too poor to work in view of the transport difficulties then existing.

Prior to 1914, Australian prospectors continued to penetrate the hinterland of Morobe, and gold in payable quantities was found in Koranga Creek, a tributary of the Upper Bulolo River. A lull in prospecting occurred during the War, but during 1921 and 1922 prospecting was resumed, and two prospectors, after crossing the Kuper Range of 10,000 ft. altitude, came into the Bulolo Valley and found gold at Koranga Creek. Here it was reported that 20 oz. of gold were recovered per day with the help of only a few natives and the use of most primitive methods. A number of other miners soon came into the field, but transport costs (chiefly for food) from the coast were so high that the recovery of less than 10 oz. of gold per day per miner was considered unremunerative.

One miner, C. J. Levien, who had been working alluvial ground for some years, realising that the field could never be properly developed without the help of big companies with sufficient capital, suitable transport from the coast and large-scale operations, went to Adelaide in 1926 with the idea of organising the industry. He succeeded in forming a company, Guinea Gold N.L., which took control of his leases along the Bulolo River.

Later, a pioneer flight made in 1927 in a De Havilland No. 27 machine by Capt. A. E. Mustar from Lae to a landing ground roughly prepared by Levien in the neighbourhood of Wau, showed that the transport problem both for plant and personnel could be solved by using aircraft, the construction of roads not then appearing feasible. Shortly afterwards, Capt. Mustar with a new all-metal plane made 67 trips in 5 weeks and carried, in addition to passengers, 52 tons of goods to the goldfields.

An important organisation, Guinea Airways Ltd., was next formed, and soon there were 12 aeroplanes flying regularly between Lae and the interior. Several smaller aeroplane companies operating from Salamaua were also formed.

The air transport industry grew rapidly, resulting in vastly

improved living conditions in the interior. At present there are 23 aerodromes on the goldfield, used regularly or in an emergency, so that an aeroplane in flight is never more than 3 or 4 minutes distant from a landing station, and the services, so far, have been maintained with remarkable freedom from accident. It is fortunate that the atmospheric conditions are such that air pockets appear to be unknown.

In November 1927 the mining interests of Guinea Gold N.L. were sold to a British Columbian dredging corporation, Placer Development, Ltd., the equipment and transport business being taken over by Guinea Airways Ltd., which was already using all-metal aeroplanes, each capable of taking a load of one ton.

Active testing of the dredging ground purchased by the company in the region of Bulolo on the Bulolo River (marked " B " on the map) was begun in July 1929, 118 drill holes and 6 shafts being put down to bed rock, at an average depth of 22 ft. As a result, it was estimated that there were 40 million cu. yds. of wash, worth 2*s.* 0*d.* per cu. yd. after allowing for payment of a Government royalty of 5 per cent. *ad val.* It was found that the gold was distributed all through the gravel, but concentration occurred towards the bottom. The dredging area was 4½ miles along the river and 2,000 ft. wide, the river in the locality being 200 ft. wide.

At the conclusion of the testing an operating company, the Bulolo Gold Dredging Co., Ltd., with capital provided by London and South African groups, was formed to work the property.

Two electrically-driven dredges were subsequently installed capable of digging to a depth of 40 ft. by means of buckets, each with a capacity of 10 cu. ft. and large enough to remove the biggest boulders likely to be met with in the wash. The heaviest items, the tumbler shafts, each weighed 6,950 lb. As air transport was then considered the only feasible method of carrying the parts from the coast to the dredging field, two all-metal aeroplanes were ordered. The craft were modified with loading hatches and were capable of carrying a 7,000 lb. load, two airmen and 90 gallons of petrol—sufficient for a return flight between Lae and Wau, 65 miles apart by the air route taken. Guinea Airways Ltd. bought a third similar machine, the three machines costing £90,000. The aeroplanes

being of all-metal construction, hangars were unnecessary. They operate from aerodromes built by the Bulolo Company adjacent to the port of Lae and at Bulolo, Lae being a port where ocean vessels can anchor in fair weather within a short distance of the shore. The cargo, after transhipment at Lae to three 100-ton steel pontoons which are towed to a small wharf, is loaded into railway trucks by a 10-ton travelling crane and transported a short distance to the company's centre of operations at the aerodrome. This same crane (together with a large derrick), is also used for loading the aeroplanes.

The Bulolo aerodrome is built on a piece of approximately level sandy ground, 1,000 yds. long by 500 yds. wide, which was cleared of timber growth including cedar trees 4 ft. in diameter. It cost £5,000 and took 5 months to construct. The only maintenance expense is the cutting of the grass by natives.

Wireless telephone stations at Lae and Bulolo enable pilots to ascertain the weather conditions before starting a flight. The time of a flight to the goldfield is about 40 minutes on the outward journey and 30 minutes on the return.

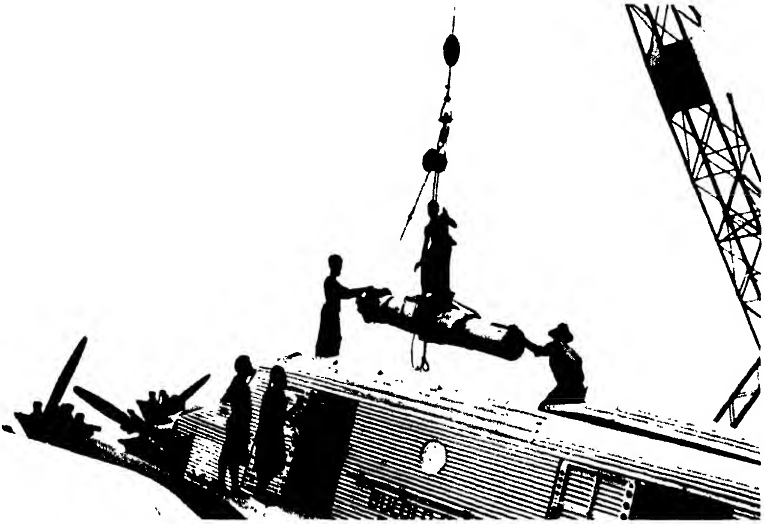
For supplying electric power to the dredges a water-race, 7,710 ft. long, was built from the Bulolo River, the water being delivered to four 1,000 h.p. turbines, direct-coupled to Metropolitan-Vickers generators, the stators of which were each wound in one piece weighing 7,000 lb. and just able to be carried by the aeroplane.

Later, an auxiliary electric power station was built at Baiune Creek near the town of Bulwa and 3½ miles below the junction of the Bulolo and Upper Watut rivers. This plant consists of five generators direct-coupled to Pelton wheels of 5,000 aggregate h.p. The power produced is used by the dredges and for other company requirements ; it is also sold to the town of Wau, to saw-milling concerns, and to New Guinea Goldfields, Ltd., who take 1,000 h.p.

Air transport of the Bulolo Company's material to Bulolo aerodrome began in April 1931, and during the following year over 2,000 tons were transported. By November 1, 1938, no less than 24,582 tons of cargo had been brought into the field from Lae. No. 1 dredge was operating in March 1931 and No. 2 in October 1932. Meanwhile, Placer Development had secured a second, almost contiguous, patch of dredging ground

PLATE IV

GOLD MINING IN NORTH-EAST NEW GUINEA.



[By courtesy of Bulolo Gold Dredging, Ltd

FIG. 1. LOADING A 6,950 LB. DREDGE TUMBLER SHAFT.

[By courtesy of Bulowat Syndicate

FIG. 2. SLUICING AURIFEROUS GRAVEL.

PLATE V

GOLD MINING IN NORTH-EAST NEW GUINEA.

[By Courtesy of Bulolo Gold Dredging, Ltd.

ELECTRICALLY-OPERATED DREDGE ON THE BULOLO RIVER.

facing page 257]

(marked " A " on the map) in the Bulowat area, estimated to contain 60 million cu. yds. of wash and to yield a net profit of 15*d*. per cu. yd.; this was sold to the Bulolo Company. Two more dredges, identical with Nos. 1 and 2, were therefore obtained to work this area. No. 3 began digging at the end of 1933 and No. 4 in August 1934, when it was found that a large proportion of the upper area, " B," had been worked to a false bottom only, the true bedrock being at a depth of about 80 ft. below water-level. Another dredge, No. 5, with digging range down to 85 ft. below water level, or through a total depth of wash of 135 ft., was accordingly built and began working in December 1937. A small dredge, No. 6, was also built to dig in a patch of wash, marked " C " on the map, 6 miles above the Bulolo area " B " and near Wau, between Poverty Creek and Wau Creek, and began work in March 1938.

To assist in the deeper digging, two more dredges, Nos. 7 and 8, similar to No. 5 but embodying the latest improvements, were ordered; No. 7 was floated in October 1938 and No. 8 is expected to be ready in July 1939, when the Company will have eight dredges in operation.

According to the report of the Bulolo Company for the year ended May 31, 1938, there were 192 million cu. yds. of dredgable gravel reserves in addition to 20 million yds. which will be treated hydraulically. For the four months from May 31 to October 1, 1938, the six dredges dug 4,803,000 cu. yds. and recovered 52,918 oz. of fine gold, working costs, not including amortisation, being about 5½*d*. per cu. yd.

Next in importance to the alluvial deposits on the Bulolo were those on the Edie Creek, which were discovered in February 1926 by Glasson and Royal. Edie Creek rises on the eastern slopes of Mount Kaindi, which attains an altitude of 8,000 ft. above sea-level. The area in which the discoveries were made is at an altitude of between 6,000 and 7,000 ft. and covers about 15 sq. miles. The climate is very cold and the rainfall averages 104 in. per annum. The surface of the ground in the neighbourhood is very rugged and is covered with tangled vegetation which makes approach to the area difficult. The deposits, auriferous gravels lying in the creek beds and in the banks alongside, were small but extremely rich, 1 oz. of gold to the pan being not unknown.

Glasson and Royal were joined by four other miners and the richest leases on the Upper Edie and on its tributaries, Merri, Midas and Mystery Creeks, were pegged. The gold was won in the simplest way, nearly all the work being done by natives. The discovery becoming known, other miners soon arrived, their numbers so increasing that by the end of 1926 there were over 100 men with their native labour gangs on the spot.

Towards the end of 1926 the Royal-Glasson group of alluvial leases was absorbed by Edie Creek Proprietary, Ltd., and hydraulic sluicing and elevating plants were installed.

Soon after the establishment of the air transport to Wau, and owing to the impossibility of making a local landing field, a mule track, 9 miles long, was cut from Wau to the Edie field; conditions were thus much improved and supplies cheapened. In 1934 a new road, 12 miles long, was built, capable of carrying lorry traffic, transport costs being thereby further reduced. When the Edie Creek alluvial began to be worked out, an active search for primary gold-bearing quartz reefs or lode formations was prosecuted. Prospecting, however, was difficult, not only on account of the precipitous and heavily-timbered nature of the ground, but also by reason of the usual surface of humus and moss, so that deep trenching and costeaning were necessary before the lode outcrops could be disclosed.

Although prospecting had been carried on, the first lode to be found—in June 1927—was discovered by accident, gold-bearing stone being detected in the soil adhering to the roots of a fallen tree. This lode was the Day Dawn which crossed Merri Creek just above its junction with Upper Edie Creek. Soon afterwards the Edie No. 1 reef was discovered on the Royal lease of the Royal-Glasson interests. Later, other reefs, Edie No. 2, Karuka, Edie No. 3, and Edie No. 5 were found.

In November 1929 a company known as Day Dawn (New Guinea) Ltd. was formed to work the Day Dawn property, which covered 200 acres. The chief vein, of average width 3 ft. 6 in., was of uniform grade of over 1 oz. per ton for 450 ft. along the strike. It was worked from adits and levels 50 ft. apart down to a depth of 450 ft. The south end of the reef was manganiferous and the ore difficult to treat.

A power plant, consisting of a boiler fired by wood, a 60 h.p. vertical engine, various pumps and an electric generator (all sectionalised), was imported by aeroplanes to Wau and thence by carriers to Edie Creek. A treatment plant, consisting of rock-breaker, two Chilean-type mills 12 ft. in diameter, amalgamating plates, a berdan pan for grinding blanketings with mercury and a cyanide sand unit, was installed. Eighty per cent. of the gold was recovered by amalgamation, and 14 per cent. by cyanide treatment. The mine ran very profitably for four years, but the gradual working out of the best grade of ore caused the company to close down in June 1935. A cyanide plant was installed at the mine in 1935 to treat the accumulated tailings but was never put into operation.

New Guinea Goldfields, Ltd., a Sydney company, formed under the aegis of The Mining Trust, Ltd., in 1929 to acquire alluvial and reef ground in the Edie area, is now a most important mining organisation, being second only to Bulolo Gold Dredging. Its holdings cover 15 sq. miles. In the Upper Edie the Company is exploiting five separate veins by means of adits, workings having reached a depth of 500 ft. Treatment of the ore is effected in a 20-stamp battery by amalgamation, followed by cyanidation in sand and slime plants. Precipitation is by the Merrill-Crowe process.

As the local timber used in underground working rapidly deteriorates and soon becomes unsafe, maintenance cost is high, and development work is never far ahead of production.

At a lower altitude, the company works the Golden Ridges and the Upper Ridges mines near Namie Creek. The former is equipped with a stamp mill and cyanide plant, but, as its own ore reserves are approaching exhaustion, the plant will in future be supplied mainly from another property, viz., Upper Ridges and Anderson's Creek lode.

Ore reserves, proved and possible, in the Upper Edie are about 90,000 tons, averaging 6 dwt. of gold per ton; those at the Ridges are roughly 80,000 tons averaging 5 dwt. The future of reef mining in the neighbourhood seems limited and no fresh discoveries of any note have been made for some time.

New Guinea Goldfields also works a number of alluvial deposits in the Edie-Wau area by means of nozzles and elevators, the reserves of ore being estimated at 1,200,000 cu. yds. of average value 5*s.* 2*d.* per cu. yd. In the Koranga Creek area

the company holds concessions carrying alluvial wash 100 ft. deep containing 9 million cu. yds. with an average value of 1*s.* per cu. yd. This area, as well as the adjoining alluvial district owned by Koranga Gold Sluicing, Ltd., are to be worked by sluicing.

New Guinea Goldfields have recently purchased all the rights of Bulolo Gold Deposits which cover deep alluvial ground between Little Wau and Hospital Creeks, and water rights on Big and Little Wau Creeks. Water will be supplied from the latter to work the Koranga Creek sluicing scheme. The alluvial ground is to be tested to determine if it is worth dredging. The company is about to work leases on the left bank of the Bulolo below Edie Creek and on the right bank of the Bulolo, obtaining water to work the latter by pipe line from Kulolo Creek.

The working profits of the company for the financial year 1937-1938 were £9,182 on reef and £50,377 on alluvial mining.

In 1930 and 1931 New Guinea Developments N.L. carried out work on a lode situated just west of Slate Creek, a tributary of Edie Creek.

In 1934 the Edie Creek Gold Mining Company commenced operations and installed a small direct cyanidation plant. Recently, Enterprise of New Guinea Gold and Petroleum N.L. (incorporated as Enterprise of New Guinea N.L. in 1933) have carried out development work on the mine and enlarged the plant. The company is also engaged in hydraulic sluicing on the Upper Watut River.

All the lower part of Edie Creek is worked by individual miners, one having established his own power plant, saw mill, workshops and electric winches.

The Sandy Creek Gold Sluicing Co. is working a deposit with elevators at Sandy Creek on the right bank of the Bulolo some 5 miles from Wau. The annual profit is stated to be nearly £6,000, working costs 1*s.* 2*d.* and returns 3*s.* 6*d.* per cu. yd. Reserves sufficient for at least six years are claimed to be available.

At Cliffside, just below Wau on the Bulolo, an early lease is still being profitably worked with nozzles and elevators, using water obtained from Webiak Creek.

Lower down the river, between the Bulolo and Bulwa dredging areas, a number of other claims are being worked.

The Bulowat Syndicate is working a sluicing claim several acres in extent, with wash 15 to 30 ft. deep, on the left bank of the Bulolo, near the Bulowat Drome, 18 miles from Wau, and is notable for the operation of a very effective modification of ordinary sluicing procedure. The main sluice box, 110 ft. long with cross section 4 ft. by 18 in., iron-lined and sloping 1 in 20, is riffled for 80 ft., the next 10 ft. being perforated with $\frac{3}{8}$ in. slots and the last 20 ft. being drilled with $\frac{1}{4}$ in. holes 1 in. apart. One-half of the fine material of the flow gravitates through the perforations and is distributed over two tables below, sloping right and left 1 in 8, each 18 ft. long and divided into sections 2 ft. wide which are riffled. The tables are responsible for increasing the recovery by 25 to 30 per cent.

The largest sluicing company at present operating on the Morobe field is Sunshine Gold Development, Ltd., which has an area of 300 acres on the Watut below Bulwa. Monitors under 500 ft. head, and three elevators are employed. The wash reaches a maximum depth of 60 ft., and about 26,000 cu. yds. are treated per month at a cost of 10*d.* per cu. yd.

Virtually the whole river stretch between Sunshine and Marilinan, a distance of 40 miles, is pegged and worked by individual miners, either by sluicing or by box and dish methods. There is a proposal to erect a plant on one of the Watut tributaries to supply power to work gravel pumps and elevators on the flats on the right bank of the river.

Although Kapule Creek, one of the tributaries of the Upper Watut River, rises eight miles south-south-east from Mt. Kaindi, close to Edie Creek, very little alluvial gold has been found in it. Other tributaries, Surprise, Iroa, and Roaring Creeks, however, have been well-known alluvial grounds. The first is worked out; on the others a few patches are still being worked. Payable gold was discovered in 1928 in Hidden Valley Creek, a head stream of the Upper Watut River, but it has since been worked out.

Upper Watut Alluvials was formed in 1935 to work auriferous deposits on Slate and Iroa Creeks, but ceased operations in 1937. Individual miners are still operating in the area.

An alluvial area on Black Cat Creek between Wau and Salamaua on the eastern side of the Kuper Range was found in 1930 and has been worked by a number of individual miners.

In the Upper Ramu River area payable alluvial gold has

recently been found and the area has been made a provisional goldfield.

In 1934 payable gold was found on the Siling River about nine miles south of Wewak. The find, however, proved to be of little importance, but attracted the attention of a number of miners who prospected further afield. About 1936, a number of mining claims were pegged at the headwaters of the streams flowing south to the Sepik River from the southern slopes of the Prince Alexander Range about 40 miles west of Wewak, and, in 1937, The Sepik Goldfield was proclaimed. Auriferous Tertiary conglomerates have been eroded by many of the streams and the gold concentrated in terraces and creek beds. Gold is recovered by simple boxing methods, but the field has proved very patchy. Reports were current that the locality would prove to be an extensive dredging field rivalling the Bulolo. Far East Alluvials, Ltd., with whom are associated Fanti Consolidated, Ltd., and Loangwa Concessions (Northern Rhodesia), Ltd., tested a large area over which they held an option. From July 1, 1934, to December 31, 1938, approximately 21,145 fine oz. of gold were won from the field. So far as is known, Far East Alluvials Ltd. has ceased operating in this field and the company is in process of being wound up.

The existing veins in the Edie Creek area could not have supplied more than a small fraction of the alluvial gold recovered there and along the river system; indeed, the bulk of the gold so far won appears to have been derived from veins previously existing in different parts of the country. Support for this theory comes from the fact that the gold recovered from different localities varies considerably in its silver content. The fineness of the gold recovered also varies considerably, e.g. Upper Edie Creek, 522; Lower Edie Creek, 627; Bulolo River and Koranga Creek, from 638 to 650; Surprise Creek, 835; Black Cat—Bitoi River, 869.

The Administration appointed one geologist in 1934 and added an assistant in 1935 with headquarters at Wau. These officers have already made preliminary surveys of the Sepik District, the Benembe Plateau, and parts of Morobe Goldfield.

The various townships on the Morobe field have already been mentioned, but some details concerning them may be of interest. Wau, the largest, is the headquarters of the local Mining Administration staff (which includes the Warden of

the Morobe Goldfield, an Inspector of Mines, a survey and drafting staff and two geologists). In the town there are stores, two hotels, a club, a European hospital, a cinema, electric light and power, motor cars and trucks, and livestock including draught oxen, all due to the opening up of the country by air transport, for as yet there is no road from the coast.

The smaller townships of Bulolo and Bulwa, similarly equipped, were laid out by the Bulolo Gold Dredging Company for their employees. Gardens near the townships provide an ample supply of fresh vegetables. Motor roads have been made in the interior, including one from Wau to Sunshine, a distance of about 31 miles, which crosses the Bulolo twice by steel bridges. A road from the coast has been mooted for some years.

In 1938 the Commonwealth of Australia, by the New Guinea Loan Guarantee Act, 1938, guaranteed the repayment of, and payment of interest upon a loan not exceeding £150,000 to be raised by the Administrator of the Territory for the purpose of constructing a road from Salamaua on the coast to Wau. Reconnaissance surveys of four routes have been made from Salamaua, their approximate distances being 49, 55, 97, and 118 miles. The short route following the Bitoi River Valley seems favourable, although the avoidance of a large section of river-gorge country appears necessary and a deviation to surmount this obstacle is now under investigation. An attempt is being made to have the ruling gradient about 1 in 15, but it is probable that considerable lengths of 1 in 12 will be necessary. Finality has not yet been reached as to the route the road will take, but when this is determined and the cost involved ascertained, it is expected the construction will be put in hand. The road would be welcomed by a number of small scale workers as a means of reducing working costs ; for the same reason a number of low-grade areas, already pegged but lying idle might become workable.

The Public Works Department at Rabaul estimates that the annual upkeep of this road would be about £10,000, and that the freight cost per ton (including toll for redemption and interest on loan) would be between £6 and £7 as compared with the present cost of £15 to £20 per ton by aeroplane.

At the present time three aeroplane companies with over

thirty machines are carrying on services not only between Lae and Salamaua and the interior, but also between Wau and Port Moresby in Papua Territory. With this last service, started in 1933, the planes cross the mountain backbone at an altitude of 13,000 ft. In May, 1938, W. R. Carpenter and Company, Ltd., of Sydney and Rabaul, initiated an air service between Sydney and Rabaul. This service enables the journey from Rabaul to Sydney to be completed in three days and from Salamaua to Sydney in two days.

The climate in the Bulolo region may be described, for a tropical country of about 2,500 ft. altitude, as good. Day temperature is always below 90° F., whilst the nights are cool. The average annual rainfall is about 70 in., the rain falling mostly in the late afternoon or at night. Malaria is being eliminated.

As to the future of North-east New Guinea, much depends on what fresh discoveries of gold deposits are made. A large amount of uncontrolled country remains to be examined and prospected. On the Morobe field a decreasing output from the smaller operators may be expected, while the big operator, the Bulolo Gold Dredging Co., Ltd.; is likely to keep working for some years.

All monetary statements given above are in Australian currency.

PROGRESS IN COLONIAL MINERAL INDUSTRY

Comprising periodic statements on mining and geological activities received from Government Technical Departments overseas.

BRITISH GUIANA

The Imperial Institute has received from the Commissioner of Lands and Mines the following report by the Director of the Geological Survey regarding work carried out by his Department during the six months ended December 31, 1938.

The survey of the Barama River was completed and field work was extended southwards to the Iroma and Kutuau Rivers, tributaries of the Cuyuni.

Two large granitic batholiths occur on the Barama-Barima and on the Barama-Cuyuni watersheds respectively. The Barama River between Monosse and Tasawinni runs between

these and within a broad metamorphic belt intruded by small granite cupolas and by basic rocks.

The granites may be divided into two main types, viz. (1) a porphyritic hornblendic granite with pink zircon as a notable accessory mineral, and (2) a micaceous granite which is often garnetiferous. The former type is more frequently associated with the gold deposits in this area.

The metamorphic rocks consist of sheared tuffs and agglomerates; phyllites; knotenschiefer; mica-, garnet-, talc-, chlorite-, hornblende- and staurolite-schists; quartzites and jaspilites. Within this series gold-quartz veins occur, notably in the sheared volcanic rocks of the Ianna district. Similar veins occur within the granite batholith north of the Barama River.

In the Imotai District the gold is derived from metamorphosed basic rocks intruded by hornblende-granites. This occurrence is similar to that of the area on the Barama-Barima road between the Mazawini and Takatu Rivers.

The basic rocks consist of amphibolites, epidiorites and hornblende-schists forming high, irregular massifs. Their origin is obscure. They may represent metamorphosed roof-rocks and pendants, metamorphosed basic intrusives, basic volcanics, or even differentiates from the adjacent granite batholith.

A high ridge of metamorphic rocks forms the watershed between the Cuyuni and Barama Rivers in the Iroma District; the gold workings of this area are related to the contact between these rocks and the granite batholith.

A feature of interest in the Waini area is the occurrence of elevated deposits of the White Sand Series. These occur at a height of 450 to 650 ft. above sea-level, in a narrow trough flanked by hills rising to 1,300 ft. Worn gravels occur at the base, and these become coarser and diamond-bearing southwards.

Gold.—The output of gold from the two dredges operated by the British Guiana Consolidated Goldfields Co. in the Mahdia River amounted to 6,421 oz. in 1938. Prospecting work by engineers of the same company in the Konawaruk River is reported to have proved an extensive area of dredgeable ground.

Extensive prospecting was carried out in the Oko and Aremu Rivers on areas held by another company, the British Guiana Goldfields Ltd., but results up to the present have not justified expectations.

The old Aremu Mine from which a total of 6,488 oz. of gold was produced between 1909 and 1911 has recently been examined by diamond drilling. The results were disappointing and the work has been discontinued.

In the Aurora section of the Cuyuni River detailed prospecting by the Solar Development Co., a Canadian concern, has failed to show a sufficiently large ore-body to warrant further work in this area.

Attention is again being directed to the Aranka goldfield (Cuyuni); a company has been formed to work the flats and hills adjacent to the Sir Walter Creek by means of a drag-line excavator and floating washing-plant of the "Doodlebug" type.

Quartz milling on a small scale is proceeding in the Barama and Mazaruni Rivers; a number of 2-stamp mills and ball mills are working successfully in these areas.

Bauxite.—The Demerara Bauxite Company are extending their operations to deposits on the left bank of the Demerara River, for which purpose a railway bridge across the Demerara above Mackenzie is being constructed.

A new company, The Berbice Co., Ltd., has recently been incorporated in the Colony with the object of working bauxite deposits in the Berbice District. An early commencement of operations is anticipated.

Investigations have been carried out of the known bauxite occurrences in the Essequibo and North-west Districts; no workable deposits have, as yet, been found in these areas.

Mineral Oil.—A seismic survey is being conducted in the Courantyne District over the areas recently taken up by the Central Mining and Investment Corporation. It is understood that the survey will later be extended to the coastal portion of the North-west District. The object of the survey is to determine the nature and thickness of the coastal deposits; these deposits have been proved by artesian wells to attain a thickness of at least 1,600 ft. in the Berbice-Courantyne area; other evidence suggests that the total thickness may be at least twice this figure.

Manganese.—Further work on the manganese deposits discovered by Dr. Bryn Davies in the Barama River area indicates the possible occurrence of a workable deposit of commercial ore. A report on the deposit and on some gold occurrences in the same area is given on pp. 245-251 of the present BULLETIN.

The following Geological Survey Bulletins have recently been published:

G.S. Bulletin No. 8—Memorandum on the Occurrence of Bauxite in British Guiana, by D. W. Bishopp.

G.S. Bulletin No. 11—Geology of the Superficial and Coastal Deposits of British Guiana, by D. R. Grantham and R. F. Noël-Paton.

G.S. Bulletin No. 12.—Reports on the Cuyuni District, by D. R. Grantham and S. Bracewell.

MINERAL PRODUCTION, 1938.

The following data have been received from the Commissioner for Lands and Mines.

Bauxite.—The quantity of dried ore exported (containing 60 per cent. or over of Al_2O_3) amounted to 376,368 tons valued at \$4.99 per ton f.o.b. Mackenzie, as compared with 300,707 tons in 1937. The stock of this ore at mines on December 31, 1938, amounted to 85,314 tons. In addition there remained an accumulation at the mines of over 575,000 tons of ore containing from 30 to 50 per cent. of Al_2O_3. The principal exports of bauxite went to Canada (283,243 tons), Ireland (65,490 tons), Great Britain (14,768 tons), and Czechoslovakia (8,561 tons.)

Diamonds.—The stones exported aggregated 33,508 metric carats, valued at £78,569, as compared with 34,556 carats in 1937. The stones were exported principally to Belgium (21,292 carats), Great Britain (9,744 carats), Holland (2,012 carats) and the United States (422 carats).

Gold.—The exports of gold, all of which was won by alluvial mining, amounted to 39,728 fine oz. during 1938, as compared with 39,047 oz. for the previous year.

BRUNEI

According to the British Resident, the net production of *oil* for the first quarter of 1939 (after deducting oil consumed in production, and losses in transport and in treatment at refinery) was 185,923 tons. The whole of the output was exported. During the same period 32 tons of *coal* were produced, but none exported.

CYPRUS

The Acting Inspector of Mines has submitted the following data regarding mineral production during the first three months of 1939.

The production of cupreous pyrites showed an increase for the first three months of 1939, compared with the previous three months of last year. There was very little activity in prospecting during the period. Exports of asbestos fibre showed a marked decrease.

	Production.	Exports.
Cupreous pyrites (dry weight)	*Tons.*	*Tons.*
Skouriotissa Mine	39,132	41,314
Mavrovouni Mine	209,825	53,223
Lymni Mine	1,789	3,996
Kalavaso Mine	14,445	7,150
Cupreous concentrates (dry weight)		
Mavrovouni Mine	—	53,223
Chrome iron ore	—	1,100

	Production.	Exports.
Gold (contained in ores, concentrates and precipitates)	Tons. —	Troy oz. fine. 2,575
Silver (contained in ores, concentrates and precipitates)	—	15,202
Asbestos (Tunnel Asbestos Cement Co., Ltd.)		Tons.
Rock mined	3,750	—
Rock treated	45	—
Asbestos fibre	—	72
Other minerals exported		
Gypsum calcined	—	287
Terra umbra	—	1,405
Terra verte	—	6

MALAY STATES (FEDERATED)

The following data for the period January to March 1939 have been compiled from returns furnished by the Chief Inspector of Mines.

PRODUCTION (INCLUDING BUFFER STOCK) OF TIN ORE.

State.	Metal content. (*Long tons.*)
Perak	5,050
Selangor . . .	2,608
Negri Sembilan . .	263
Pahang . . .	347

Other minerals produced were: gold, 9,269 troy oz.; tungsten ores, 59 tons; coal, 87,279 tons; china clay, 87 tons; amang, 1,117 tons; and haematite, 210 tons.

MALAY STATES (UNFEDERATED) AND MALACCA

According to returns furnished by the Chief Inspector of Mines, exports of minerals during the first quarter of 1939 were as shown.

EXPORTS OF MINERALS, JANUARY-MARCH 1939

State.	Tin in Ore at 75.5 per cent.	Gold.	Manganese Ore.	Wolfram.	Bauxite.	Iron Ore.
	(*Long tons.*)	(*Oz.*)	(*Long tons.*)	(*Long tons.*)	(*Long tons.*)	(*Long tons.*)
Johore .	120*	—	—	—	29,828	109,941
Kedah .	38	—	—	37	—	—
Perlis .	45	—	—	—	—	—
Kelantan .	2	203	924	—	—	—
Trengganu	65	—	—	23	—	40,010
Malacca .	18	5	—	—	—	—
Total .	288	208	924	60	29,828	149,951

* *Excluding tin in Buffer Stock.*

JOHORE

The following information has been compiled from reports supplied by the Acting Warden of Mines.

At the end of 1938 the total area held under Mining Licence or Mining Certificate (excluding unsurveyed concessions) was 12,467 acres, an extremely small proportion of the State's total area of 4,736,000 acres, and was composed as follows: tin, 10,764; iron, 1,462; bauxite, 129; gold, 89; wolfram, 19; and china-clay, 4 acres. Tin alone showed an increase over 1937, the area in that year being 8,893 acres.

The year 1938 was a very difficult one for tin miners owing to the very low quota releases, and many Chinese miners worked at a loss as they were unable to stop operations owing to heavy financial liabilities.

Tin Ore.—Details regarding the various methods employed in winning tin ore are as follows:

Method of recovery.	Cost of production at mines.	Mines operating at end of 1st quarter, 1939.
Dredging . . .	14 cents per cu. yd.	1
Gravel-pumping . .	35 ,, ,, ,,	25
Hydraulicking . .	24 ,, ,, ,,	1
Opencast (small workings)	25 ,, ,, ,,	27

Some 619 Dulang passes were issued during 1938. These passes are issued to individual women to wash for tin ore, the holder of each pass being permitted to win and sell 22 catties (29·3 lb.) of tin ore in one month.

Exports of tin ore from the mines are governed by the International Tin Quota Release each quarter of the year. The difference between the amount of tin ore produced and the amount exported is held by the miners as permissible stocks which are governed by the Tin Restriction Scheme and represent a percentage of the assessment of each mine. In 1938 44 per cent. of the total exports was from European-owned or -managed mines, the remaining 56 per cent. coming from mines under Chinese management. In the first three months of 1939, however, these percentages were 40 and 60 respectively.

In 1938 the total tin ore production of the State was 1,167 tons; the total exports for the same year were 1,041·7 tons (including exports for Buffer Stock) made up as follows:

EXPORTS OF TIN ORE
(*Long tons*)

	1938.		1939 (1st quarter).
Place of Export.	Exports, excluding Buffer Stock.	Buffer Stock.	Exports, including Buffer Stock.
Johore Bahru .	592·74	47·03	138·46
Kota Tinggi . .	281·92	55·70	66·80
Penggerang . .	44·17	20·14	17·28
Total . .	918·83	122·87	222·54

The total exports in 1937 were 1,077·62 tons.

A number of Boring Permits and Prospecting Licences have been issued for tin ore and, with the exception of the Prospecting Licence issued for an area at Pelepah, they all refer to alluvial areas. In the case of Pelepah, the Licence covers iron and tin ore. The area at Pelepah Kanan and Kiri is being prospected by underground methods. A considerable amount of driving and cross-cutting has been done, but insufficient so far to enable an estimate of the probable tonnage of the deposit to be made.

Iron Ore.—There are only two iron mines in the State, one in the vicinity of Endau on the east coast, and the other near Yong Peng on the west coast, both owned by Japanese companies. All the ore produced, which is haematite and limonite, is exported to Japan where it is smelted.

Owing to the very heavy seas during the monsoon period (November to March inclusive), it is impossible to export iron ore from the east coast as the ore cannot be transferred from the lighters to the steamers anchored about half a mile from the shore. The mine near Endau decided during 1938 to continue production during the monsoon period and store the ore, so that the whole of the year's production will be exported during the period April to October inclusive. On the other hand, the mine on the west coast is able to export throughout the whole year as that coast is not affected by the monsoons.

In 1938 the total export of ore from Johore was 549,960 tons, of which 174,982 tons were exported from Endau and 374,978 tons from Batu Pahat. During the first three months of 1939 the figures were 109,941 tons, 1,383·2 tons and 108,557·8 tons respectively.

Bauxite.—Mining for bauxite in Johore commenced as late as 1936, when only 36 tons were exported. Since then the excavating and washing plants have been enlarged and the output has increased considerably. At present there are only two producing mines, one, the Pasir Mine of the Ishihara Sangyo Koshi, Ltd. (a Japanese company), situated near Batu Pahat on the west coast, and the other, the Sungei Kim Kim Mine with a Chinese owner, namely Lim Tua Beck. As the result of a discovery of bauxite at the Sri Medan iron ore mine of the Ishihara Sangyo Koshi, Ltd., near Batu Pahat, a washing plant has been erected and it is expected that this mine will be in full production by the end of the first half of 1939.

In 1937 12,628 tons of bauxite were exported; in 1938 exports amounted to 55,751 tons, 40,766 tons being exported from Batu Pahat and 14,985 tons from Penggerang. In the first quarter of 1939 the total exports were 29,828·40 tons, of which 17,032·22 tons went through Batu Pahat and 12,796·18

tons through Penggerang. All the ore is exported in the crude state to Japan where it is treated and smelted.

Prospecting for bauxite continues and preliminary operations under one Prospecting Licence have exposed another deposit, but its limits or tonnage will not be known until further exploration work has been completed.

Gold.—Small quantities of gold are won by a few Chinese from several small alluvial workings. The production in 1938 was 37·43 troy oz. and during the first three months of 1939 9·33 troy oz.

China Clay.—The exports of china clay for the year 1938 were 392 tons. There was no production during the first quarter of 1939.

NIGERIA

The Imperial Institute has received the following information from (1) the Director of the Nigerian Geological Survey regarding the work carried out by his Department during the period July to December 1938, and (2) the Acting Chief Inspector of Mines, with reference to mineral production for the first quarter of 1939.

Gold.—No field work has been done on the goldfield during the half-year under review but a general report is in preparation.

There is little to report on the state of gold mining, which remains entirely alluvial. The production of 12,648·68 oz. for the second half of 1938 was a little more than that for the first half. The total for the year was 24,818 oz., only 1,129 oz. lower than for 1937, so that the rapid decline in production from 1935 has been arrested.

Geology.—The investigation and mapping of the sedimentary rocks of Sokoto Province was continued. A small amount of geological work incidental to water supply investigations was carried out in Gombe Division of Bauchi Province and in Kano Emirate. An occurrence of *black lignite*, in upper Cretaceous rocks, brought to light by natives digging a well at a village some twenty miles north-east of Gombe, was reported. The seam is 6 ft. thick, but appears to be of limited lateral extent. It is of interest, as it lies about 200 miles north-east of the lignite near Lafia Beriberi which was the most northern occurrence previously known. Since the Cretaceous rocks are continuous throughout the intervening country it is possible that further deposits of lignite may be found.

Water Supply: *Drilling.*—The water supply for the Nigerian Railway at Nguru has now been successfully installed. A supply of good, perfectly clear water, well in excess of present demands, is being pumped from the second borehole which is 121 ft. deep. A request for a supply at an intermediate watering point, Mallam Maduri, has been made, but cannot

be acceded to at present as the drill has been transferred to Sokoto in order to obtain an adequate supply for that city.

Water Supply: *General.*—Well sinking continues in the provinces of Sokoto, Katsina, Kano, Bauchi, Bornu and Owerri. The number of wells sunk during 1938 was 124. The programme of sinking in the Ishan Division of Benin Province has been completed. Of the eleven wells sunk in this unpromising plateau area, two were failures and two give only poor yields. The remainder are producing ample supplies of good water and are greatly appreciated by the inhabitants who were previously ignorant of wells tapping ground-water. The geophysical prospecting by which the sites of these wells were determined has been justified. Without it the proportion of failures would certainly have been much greater.

Mineral Production.—The production of minerals in the Colony during the first quarter of 1939 was as follows: tin ore, 2,530 tons; gold, 6,406 troy oz.; wolframite, 45·9 tons; columbite, 76·5 tons.

NORTHERN RHODESIA

The following statement relating to mining activities during the first quarter of this year has been abstracted from a detailed report forwarded by the Chief Inspector of Mines.

MINERAL PRODUCTION, JANUARY-MARCH 1939

Gold	797 oz.
Silver	9,904 ,,
Cobalt alloy	19,497 cwts.*
Copper, blister	41,190 tons
,, electrolytic	7,545 ,,
Vanadium pentoxide	168·45 tons
Zinc	3,050 tons
Limestone	9,558 ,,
Mica	930 lb.
Silica rock	1,793 tons

* *Including* 116 *cwts. not previously returned.*

Copper.—The quantities of ore treated and metal produced by the Mufulira, Nkana and Roan Antelope mines are shown in the subjoined table.

Mine.	Ore Treated.		Copper Recovered.			
			Blister.		Electrolytic.	
	(*Tons.*)	(% *Cu.*)	(*Tons.*)	(% *Cu.*)	(*Tons.*)	(% *Cu.*)
Mufulira	389,474	4·49	14,270	99·47	—	—
Nkana	609,821	3·60	10,672	99·25	7,545	99·95
Roan Antelope	592,054	3·26	16,248	99·48	—	—
Total.	1,591,349	3·69	41,190	99·42	7,545	99·95

Cobalt Alloy.—This alloy is produced by the Nkana

Mine, and contains 40·45 per cent. of cobalt and 14·53 per cent. of copper.

Zinc and Vanadium.—The Broken Hill Mine treated 16,321 tons of ore averaging 22·9 per cent. of zinc, 4·8 per cent. of lead and 0·6 per cent. of vanadium pentoxide, and produced 1,935 tons of electrolytic zinc (99·98 per cent. Zn) and 1,115 tons of debased zinc (99·27 per cent. Zn). The company further treated 14,168 tons of ore containing 1·52 per cent. of vanadium, and recovered 168·46 tons of fused vanadium pentoxide containing 211,387 lb. of vanadium.

PALESTINE

The following statement concerning the mining industry of Palestine has been abstracted from the Palestine Blue Book for 1938, and forwarded to the Institute by the Government Geologist.

During the year under review the quantities and values of minerals produced in the Mandate were as follows:

MINERALS PRODUCED DURING 1938

Mineral.	Quantity (*Tons*).	Value (£*P*).	Remarks.
Gypsum	3,984	800	——
Cement	98,445	180,000	Finished product.
Plaster of Paris	111	—	,, ,,
Salt: Rock	444	586	Value on which royalty is calculated.
Sea	8,065	20,162	Produced by the Athlit Salt Co.
Sulphur	1,215	6,417	349 tons "Standard" quality. 544 ,, "Extra Fine" quality. 28 ,, "Superfine" quality. 294 ,, "Industrial" quality.
Potash	47,496 } export only	284,976	80 per cent. KCl.
Bromine	481 } export only	38,000	Pure refined liquid.
Magnesium chloride	51 } export only	—	44 per cent. $MgCl_2$.

The number of Mining Leases, Prospecting Licences and Prospecting and Exploration Permits granted and in force during the year is shown in the sub-joined table.

MINING LEASES, ETC., GRANTED AND IN FORCE DURING 1938

Mineral.	Mining leases.	Prospecting licences.	Prospecting permits.	Exploration permits.
Sulphur	3	–	–	1
Rock phosphate and bituminous limestone	–	4	–	–
Rock salt	1	–	–	–
Alkaline salts	–	2	3	–
Manganese and semi-precious stones, felspar, quartz, etc.	–	1	–	–
Metallic sulphides and oxides	–	4	–	–
Marble	–	–	1	–
Clay, sandstone, etc.	–	–	–	1
General	–	–	1	2

The Oil Mining Ordinance, 1938, came into force on September 1, and several applications for oil prospecting licences have since been received which are at present under consideration by the Government. Exploration for oil, however, has not yet been carried far enough to show whether workable quantities exist.

In general, the known mineral deposits of Palestine occur in seven regions or areas, as follows:

MINERAL DEPOSITS OF PALESTINE

Region or Area.	Nature of Deposit.
Dead Sea	Potash, bromine, magnesium chloride: quantities virtually unlimited.
Jebel Usdum	Petroleum: some seepages known. Bitumen: known deposits limited. Salt: quantity virtually unlimited. Gypsum (anhydrite): quantity large.
Nabi Musa	Bituminous limestone: 10 sq. km. Phosphate: 100 sq. km.
Yarmuk	Bituminous limestone: quantity not determined.
Menahemiya	Gypsum: deposits in faulted strata, quantity unknown.
Gaza	Sulphur: 1 sq. km. Petroleum: several structures located but not tested.
Akaba	Manganese: deposits large but quantity not determined. Copper: occurs as a cupriferous sandstone, as veins of malachite and cuprite in sandstone, and also in veins in igneous rocks in association with barytes and fluorspar.

The geological mapping of five sheets of the contoured 1 : 100,000 maps issued by the Survey Department has been completed. It has so far not been possible to publish these, but hand-coloured copies may be obtained by special arrangement. It is hoped that a general geological map of Palestine on a scale of 1 : 250,000 will be published in conjunction with the Hydrological Survey Reports.

SARAWAK

According to the Chief Secretary, the reported production of gold for the period December 1, 1938, to February 28, 1939, was 3,788·045 fine oz., of which 3,736·855 oz. were obtained from the Bau District and 51·190 oz. from the Kuching District. The area covered by Mining Leases at the end of February was 5,782 acres, the number of leases being 38, 37 of which grant the right to mine gold. The remaining lease, issued on June 9, 1938, over an area of 242 acres, gives the right to mine cinnabar and quicksilver. Nine Exclusive Prospecting Licences to prospect for gold, each issued for a term of one year and covering in all 1,917 acres, were also extant at the end of February.

SIERRA LEONE

According to the Chief Inspector of Mines the production of minerals during 1938 was as follows: gold (crude bullion), 32,980 troy oz.; diamonds, 689,621 carats; platinum (crude), 180 troy oz.; iron ore (exports), 861,955 tons; chrome ore (exports), 497 tons.

TANGANYIKA

The following data have been received from the Acting Chief Inspector of Mines in respect of the period January to March 1939.

During the quarter under review, minerals of a total provisional value of £210,947 were exported from the Territory, an increase of £53,570 over the corresponding period of 1938.

EXPORTS OF MINERALS

	January-March 1939.		January-March 1938.	
	Quantity.	Value (£)	Quantity.	Value (£)
Diamonds	1,074 Carats	1,952	427 Carats	554
Tin ore	93 Tons	14,699	140 Tons	18,703
Tungsten ore	—	—	16 Cwts.	154
Salt	856 Tons	5,213	896 Tons	5,637
Mica: Sheet	6·9 Tons	—	4·3 Tons	—
Waste	2·0 Tons	—	—	—
Gold (unrefined bullion)—				
Lupa Goldfiled:				
Alluvial	6,838 Troy oz.	43,403	7,507 Troy oz.	46,043
Reef	7,591 Troy oz.	38,783	3,756 Troy oz.	17,335
Musoma District:				
Reef	12,595 Troy oz.	65,612	11,674 Troy oz.	54,519
Mwanza District:				
Reef	4,803 Troy oz.	28,045	8 Troy oz.	38
Singida District:				
Reef	2,544 Troy oz.	11,815	2,743 Troy oz.	14,273
Morogoro District				
Alluvial	28 Troy oz.	187	10 Troy oz.	63
Dodoma District:				
Alluvial	—	—	11 Troy oz.	58
Kigoma District:				
Alluvial	197 Troy oz.	1,238	—	—
Gold (unrefined bullion)—				
TOTAL	34,596 Troy oz.	189,083	25,709 Troy oz.	132,329

Gold.—The decrease in the production of alluvial gold bullion from the Lupa Goldfield during this quarter, as compared with the corresponding quarter of 1938, is in accordance with the general tendency in recent years for output from this area to decrease owing to the gradual working out of the

placers, the reduction in numbers of the diggers and, more immediately, adverse weather conditions.

The increase in production from reef sources in the Lupa Goldfield is striking, the exports being more than double that of the corresponding quarter of 1938. The Saza Mine of Messrs. New Saza Mines, Ltd., as well as several of the smaller plants will shortly come into production and the Lupa reef gold output will be given an added impetus.

In the Mwanza District of Lake Province the Geita Mine of the Geita Gold Mining Company, Ltd., commenced production at the beginning of the year with its 250 tons a day plant, and during January and February crushed and cyanided 12,976 tons for a recovery of 2,895·8 fine oz. of gold. In the Musoma District of Lake Province the Mara Mine of Messrs. South and Central African Gold Mines, Ltd., continued to be the chief producer, crushing and cyaniding 4,717 tons in January and February 1939 with a recovery of 3,169 oz. of unrefined bullion. The erection of the new plant to deal with 100 tons a day at the Buhemba Mine of the South Nyanza Development Company, Ltd. (tributors, Messrs. Buhemba Mines, Ltd.), is being pressed forward. During January and February the results were: ore crushed, 2,328 tons; ore cyanided, 1,578; gold bullion recovered, 1,810·4 oz. The steady increase in production from this district is being maintained.

In the Singida District of Central Province, in which area the Sekenke Mine of Messrs. Tanganyika Central Gold Mines, Ltd., is the principal producer, production has decreased, the output for the first two months of the year being 1,410 oz. of unrefined bullion.

Diamonds.—There has been an increase in the export of diamonds during the period under review as compared with the corresponding period of 1938. Production was from the alluvial gravels at Shinyanga and Mabuki. The average value was 36·35 shillings a carat.

Tin Ore.—The chief source of tin ore remains the Karagwe Chiefdom of the Bukoba District in the Lake Province. The ore is mainly of detrital origin. There was a sharp decrease in exports as compared with the first quarter of 1938, but it is possible that stocks have been carried forward to the second quarter, particularly in view of the steadily increasing price of the metal.

Tungsten Ore.—There were no exports during the period under review. Difficulty in disposing of parcels exported during 1938 is probably responsible for the apathy in this particular commodity.

Mica.—Exports both of sheet and waste mica are again

on the increase. One enterprising producer is endeavouring to find a local market for waste mica as a substitute for sand or water in smothering outbreaks of fire.

Vermiculite.—With the assistance of the Mineral Resources Department of the Imperial Institute, the Mines Division of the Department of Lands and Mines is endeavouring to stimulate interest in the production of this mineral by putting possible producers into touch with consumers. There were no exports during the period under review. The chief difficulty is the marketing of the mineral at a competitive price.

Talc.—There have been no exports of this mineral, the small output so far attained being sold for local industrial purposes. The quality of the material is reported to be superior to Japanese talc which forms a large proportion of the imports.

TRINIDAD

The following information regarding the petroleum and allied industries of Trinidad has been forwarded by the Inspector of Mines and Petroleum Technologist, Trinidad.

Petroleum, etc.—The production of crude oil in the Colony for the quarter ended March 31, 1939, was 4,782,398 barrels, this being an increase of 16·31 per cent. on the figure for the same period of the year 1938. The production for the year 1938 amounted to 17,737,201 barrels, or 14·41 per cent. more than the figure for the year 1937.

The crude oil was produced from the following fields: Barrackpore, Boodoosingh, Brighton, Cedros, Coora, Fyzabad, Guayaguayare, Lizard Springs, Los Bajos, Palo Seco, Parry Lands, Penal, Point Fortin, Tabaquite and Vessigny.

At the end of 1938 there were 16 oil companies operating in the Colony.

The following table shows the quantities of petroleum and its products exported during the quarter ended March 31, 1939.

EXPORTS OF PETROLEUM, ETC., DURING JANUARY-MARCH 1939

(*Imperial gallons*)

Crude oil	1,924,838
Fuel oil	115,325,024
Gas oil	292,624
Lubricating oil	585
Kerosene	787,995
Motor spirit	40,453,869
Road oil	317,528

Asphalt.—The total quantity of asphalt mined during the quarter ended March 31, 1939, amounted to 41,671 tons; the output for 1938 was 127,859 tons compared with 104,062 tons for 1937.

The quantity of asphalt exported during 1938 was 85,089 tons as compared with 90,872 tons for 1937.

UGANDA

The following information has been received from the Acting Director of the Geological Survey of Uganda regarding activities of the Survey during the first three months of 1939.

Gold.—Little or no change has been noticeable in the gold output during the period under review and no new sources have added to the supply. The sandstones and grits of the Buhwezu plateau have been found to contain gold in payable quantity, the gold owing its origin to the development of stockworks of fine stringers which are often marked by well crystallised quartz. The patchiness of these occurrences makes them impossible of assessment at present and their exploration is only in the early stages.

A large area with alluvials up to 60 ft. thick or more has recently been thrown open to prospecting in the neighbourhood of Lake George. This is in the nature of a large low-grade proposition which might be worked by hydraulicking.

Good values have been obtained from bulk samples taken from opencast workings on the new lodes recently discovered at Busia.

The production of unrefined gold during January-March inclusive is provisionally given as 5622·63 troy oz.

Tin.—After a fall in production to about one-fifth of normal in January the tin output recovered. The March figures, however, represent only about four-fifths of the average for each month of last year.

The provisional production of tin ore for the quarter was 96·676 long tons.

Tantalite and Wolfram.—Interest in tantalite has waned owing to the poor prices obtained for the last few samples exported. If a reasonable price, say comparable to that of tin and wolfram, could be obtained for high-grade tantalite, prospecting for this mineral might be encouraged.

Prospecting of wolfram-bearing veins by means of adits driven into the steep hillsides is going forward in the Mpororo Valley, Kigezi, and so far the results have been promising.

The outputs of tungsten ore in Uganda given on p. 124 of this BULLETIN (66·79 units for 1938, valued £157, and 86·93 units for 1937, valued £345) refer to wolframite.

Diamonds.—Two more stones have been sent into the office from Buhwezu, making a total of four so far discovered in Uganda.

Oil.—The prospecting drill which was operating on Lake Albert has been moved to Kibero where a series of holes are being put down to about 600 ft. This is near the point where one of the first oil seepages on Lake Albert was noticed. The seepage itself is now covered by several feet of water.

ABSTRACTS AND NOTES

New Zealand Gold Mining Industry, January-March 1939.—The following data regarding the gold mining industry during the first quarter of 1939 has been supplied by the Under-Secretary of the Mines Department.

Auriferous Quartz Mining

North Island.—The production from the Martha Mine of the Martha Gold Mining Co. is the only one of importance to record. The Talisman Dubbo and Golden Dawn Mines have experienced trouble during the period under review, and this has seriously affected their returns.

The Martha Mine during the three months ended March 11, 1939, treated 39,421 tons of auriferous quartz and produced 11,055 oz. of gold and 77,755 oz. of silver.

South Island.—Details regarding the principal mines in the west coast district are as follows:

Mine.	Quartz treated (*Long tons*).	Gold produced (*Troy oz.*)
Blackwater . .	11,098	4,927
Big River . . .	404	339

The Alexander Mine, an important mine in the district, does not appear to have had a "clean-up" during the period.

Auriferous quartz mining in the Otago district is negligible.

Dredging

South Island, West Coast District.—The output of gold by dredges in this district during the period under review was as follows:

Dredges.	Cubic yardage treated.	Gold produced (*Troy oz.*).
Argo . . .	137,600	671
Barrytown . .	661,000	1,755
Blackball Creek .	—	450
Bundi . . .	105,200	748
Gillespie's Beach .	130,960	278
Grey River . .	1,060,000	2,170
Kanieri . .	496,000	3,756
Mataki . . .	57,000	134
Mataki Junction .	127,000	256
Mossy Creek . .	88,000	370
Nemona . .	113,800	315
New River . .	49,500	183
Okarito . .	—	140
Rimu . . .	612,780	3,023
White's Electric .	76,920	330
Worksop . .	64,000	196

South Island, Otago District.—The Clutha River Gold Dredging Co., Ltd., and the Molyneux Gold Dredging Co.,

Ltd., own the principal gold producing dredges operating in this district. The Molyneux Dredge treated 207,300 cu. yds. and recovered 560 oz. of gold; the yardage treated by the Clutha Dredge, which recovered 1,816 oz. of gold, is not known.

The Austral (N.Z.) Dredge is not yet completed. The Goldfields Dredge is working previously dredged ground. Aitken's Dredge, operating in the Waikaka district, is privately owned and is working on freehold land.

Newfoundland Mineral Production, January-March 1939.—According to a statement received from Mr. C. K. Howse, Associate Government Geologist, the mineral production of Newfoundland during the first quarter of this year was as follows:

	Long tons.
Buchans	
Crude ore	113,200
Copper concentrate from crude ore	7,154
Lead ,, ,, ,, ,,	12,120
Zinc ,, ,, ,, ,,	26,169
Gravity* ,, ,, ,, ,,	102
Bell Island	
Iron ore	413,122
St Lawrence	
Fluorspar	2,367

* *Auriferous and argentiferous concentrates of lead and zinc ore*

Newfoundland Pyrophyllite.—The following note regarding Newfoundland pyrophyllite has been forwarded to the Imperial Institute by Dr. A. K. Snelgrove, Government Geologist.

Some 7,750 tons of pyrophyllite were exported from Newfoundland in the years 1904-05, since when, until recently, the quarries, situated near Manuels, 16 miles from the capital, St. John's, have been inactive.

In 1936 a field party of the Geological Survey made a detailed study of the Manuels pyrophyllite region and mapped the mineralised area at a scale of 1 in. to 100 ft. A report on "Pyrophyllite Deposits of Manuels, Conception Bay," by Dr. John S. Vhay, was published by the Survey in 1937 as Bulletin No. 7. This study revealed that the pyrophyllite (a hydrous silicate of alumina which resembles talc in its physical properties and is used for many of the same purposes) occurs in, and is formed by replacement of, sheared rhyolitic volcanic rocks adjacent to intrusive granite. Vhay's map, outlining the areas containing high-, medium- and low-grade pyrophyllite schist, showed that large quantities of each exist in the old quarry area and that probably still larger amounts of medium- to high-grade material are present only half a mile from the old workings.

The Survey's Bulletin attracted the attention of the Clinchfield Sand & Feldspar Corporation of Baltimore, Maryland, U.S.A., to the deposits. Mr. Henry M. Hanna, President of that Corporation, which is one of the most active in non-metallics in the eastern United States, visited Manuels in the early summer of 1938 and found that the pyrophyllite compared favourably with deposits which are now being worked in North Carolina. By arrangement with the Commission of Government, an old road 2¾ miles in length was put in condition for motor traffic from the quarry to the Newfoundland Railway, and in November 1938 a shipment of 1,000 tons was sent to Newark, New Jersey, U.S.A., where the pyrophyllite will be ground and disposed of to the cosmetic trade and possibly will also be used in paints, textiles, enamels and as a paper and rubber filler. It is understood that the material enters the United States duty free. During the present year larger shipments are contemplated and the operators plan to seek an additional outlet in United Kingdom markets.

The present Geological Survey of Newfoundland, inaugurated by the Commission of Government in 1934, is now one of the most active in the Empire. Since 1936 a dozen parties, headed by competent geologists, mostly from United States and Canadian universities, have been sent into the field each summer.

St. George's Coalfield, South-west Newfoundland.—The Bay St. George area contains about a thousand square miles of Carboniferous strata on its southern side and many attempts have been made to exploit on a limited commercial scale the coal seams occurring in them. In order to establish or refute the feasibility of seriously working the field, Professor Bryan carried out a survey of the seams in August of last year, the report on which has appeared recently (*Newfoundland Geological Survey, Inform. Circ. No.* 5, 1938, " St. George's Coalfield," by Professor A. M. Bryan, B.Sc., M.I.Min.E.).

The report indicates that coal occurs in Upper Carboniferous strata, but has been subjected to severe earth movements, principally thrust-faulting. This has resulted in a considerable crushing of the coal and the production of a large amount of " smalls " with a high content of intrinsic dirt, as well as rapid changes in the dips of seams that might impede systematic working and entail changes in mining methods. Moreover, it is to be expected that the relatively soft shales and clays associated with the seams will probably give rise to difficult roof conditions engendering a high accident rate and augmenting the already high extrinsic dirt content of the coal as mined.

After examining exposures of seams on the Middle Barachois

Brook, the Robinson River, and Northern Feeder, Professor Bryan came to the conclusion that though there is a considerable tonnage of coal in the St. George's Coalfield, the area is not an economic one owing to the large number of adverse factors.

Possibilities of Finding Oil in British Guiana.—A preliminary investigation of the geology of the coastal area of British Guiana has indirectly raised the question of the possibility of finding oil in the Colony. Much more work will have to be done before this question can be answered, but Dr. D. A. Grantham and Mr. R. F. Noël-Paton have expressed interesting opinions on the subject in a "Report on the Geology of the Superficial and Coastal Deposits of British Guiana" which has recently been published as *Geological Survey Bulletin No.* 11.

In the north-eastern corner of the Colony boring has proved a thickness of over 1,680 ft. of unconsolidated sands and clays, occupying what appears to be a basin, which Sir John Harrison considered might be 3,000 ft. deep in the centre. In the deeper parts of this basin, between the Berbice and Courantyne rivers, it is possible that late Tertiary beds may occur below the Pleistocene known at the surface, and should the gentle folding seen at the surface be accentuated in depth, favourable oil structures might exist. The shows of natural gas in wells in the superficial deposits are connected with deposits of lignitised material, and so do not indicate petroleum. As yet, however, the beds drilled through have been too young to provide source rocks for petroleum. Exploration of the deeper parts of the basin might reveal the presence of Miocene beds, but it is unlikely that there are any older rocks. The possible source rocks for petroleum are thus very limited, particularly when it is remembered that much of the Trinidad petroleum is believed to have originated in Eocene or Cretaceous rocks.

The next step is considered to be the establishment, by seismic or other geophysical method, of the depth of the rock floor in the Berbice-Courantyne district to determine whether there is room for the inferred older Tertiaries. An alternative would be to drill a deep boring designed to penetrate these horizons but, in Mr. Noël-Paton's opinion, the geophysical work should be accomplished first.

Mining Activities in Hong Kong.—A report by the Senior Inspector of Mines, Perak, Federated Malay States, on the Government control of mining in Hong Kong (*Hong Kong Sessional Papers*, 1938, pp. 295-321) contains interesting information on the mining activities of the Colony, as well as

recommendations for Government measures to encourage the mining industry. The island of Hong Kong itself does not appear to contain mineral deposits of economic value, but in the New Territories there are deposits of argentiferous galena, wolframite, molybdenite, ores of iron and manganese, granite for building purposes, and kaolin suitable for the manufacture of bricks and porcelain. Unfortunately there are no accurate geological maps or reports which would indicate the mineral potentialities of the Colony.

At present wolframite, argentiferous galena, kaolin and a little iron ore are being mined. Wolframite is being produced at the Needle Hill Mine, but the deposit appears to be less extensive than was originally anticipated, and under present conditions the proved ore reserves will be exhausted within two years. The wolframite occurs in quartz veins which carry a little molybdenite. A considerable amount of development work has been done, but without favourable results. Adits 1 and 2 were driven 556 ft. and 590 ft. respectively, and connected by a drift of 800 ft.; another adit, 315 ft. below, was driven 1,100 ft. to prove any ore in depth, but without success. The installation of modern plant was therefore not thought to be justified, and mining is being continued by sub-contractors. From the time the lease was issued in May 1936 to September 1938 some 1,640 piculs (110 short tons) of wolframite were produced and exported to England.

Quartz veins carrying argentiferous galena and a little pyrite and chalcopyrite are worked for lead and silver at the Lin Ma Hang Mine. The ore carries an average of 2·5 oz. of silver per short ton, and 10·4 per cent. of lead. To date, production has amounted to 5,526 short tons of concentrates carrying 15·8 oz. of silver per short ton and 69 per cent. of lead, and this has been shipped to Europe. A new mill to treat 150 tons of ore per day commenced operations in 1937, and the plant is now being increased to treat 250 tons per day.

At Cha Kwo Ling, a small opencast mine is working kaolin of good quality which is mainly exported to Japan. The output is regulated according to the demand and has dropped from 500 tons to 20-30 tons a month since the beginning of the Sino-Japanese war, but it is considered that with improved methods of treatment a more refined product might be obtained which would have a wider market and command a higher price.

Sulphur Recovery from Smelter Gases.—Reference has been made in this BULLETIN (1938, **36**, 515) to the recovery of sulphur from the sulphur dioxide generated by smelting sulphide ores, as practised at Trail in Canada by the Consolidated Mining and Smelting Co. of Canada, Ltd. It is of interest in connection therewith to note that recovery plants are also operated by

the Imperial Chemical Industries, Ltd., England; Bolidens Gruvaktiebolag, Sweden; Metallgesellschaft A.G., Germany; and Gesellschaft für Chemische Industrie, Switzerland. The processes patented jointly by the first two concerns are described in a recent article (*Min. J.*, 1939, **205**, pp. 385-386, 409-410).

It is estimated that in order to produce 20,000 tons of sulphur annually by employing waste gas containing 5 to 6 per cent. of sulphur dioxide, the total capital charge would amount to £8 per ton year of sulphur, the total works-cost being roughly £2·9 per ton year.

The I.C.I. process, unlike the Trail method which depends on ammonium sulphite, employs an aqueous solution of basic aluminium sulphate to absorb the sulphur dioxide. The plant normally consists of three or four absorption towers in which the solution runs counter-current to the flow of gas, and is cooled between towers to maintain its absorptive capacity. To check loss of basicity by the formation of sulphur trioxide, and to maintain the absorption rate, a proportion of the liquor is bled off from the circuit and neutralised with ground limestone slurry.

Gas recovery from the saturated liquor is effected in a regeneration tower heated to 100° C., and the products, sulphur dioxide and steam, are cooled in a packed tower to about 30° C., the resulting sulphur dioxide gas being then ready for drying and compressing for use as such or else converted to elemental sulphur.

Sulphur comparable in quality with the best American crude is prepared by passing the gas, together with 40 to 50 per cent. of air, through a glowing coke bed, when the dioxide is broken down completely leaving liquid sulphur.

At Rönnskär, the Boliden Company manufactures sulphur by a catalytic reaction between the smelter gases and a proportion of those gases suitably reduced by passage through a "gas-producer" coke bed. The catalyst consists of a mixture of broken pieces of ferric and aluminous oxides and is placed in two chambers to form a chequer-work. The gases leaving the second chamber are cooled in a large sheet iron cooler and the sulphur vapour condenses into droplets which are precipitated electrostatically.

The entire plant, seven units in all, is automatically controlled from one central room, and the liquid sulphur obtained is trucked from the steam-heated catchpots to weighbridges, then to a filtration plant and wooden moulds each holding several thousand tons of sulphur.

New Methods for the Production of Aluminium in Germany.—In recent years Germany has made great progress in the

production of light metals, especially aluminium and magnesium, and as a result of the improved quality of light-metal alloys, they are now replacing several foreign-controlled heavy metals. New methods for the production of light metals are surveyed by H. Grothe in *Metall und Erz*, 1939, **36**, 63-72, from which the following note regarding aluminium has been abstracted.

During the past 20 years many improvements have been made in the industrial production of aluminium, but the basic practice has not altered greatly, bauxite still being the most important raw material. In Germany the desirable grade of bauxite has to be imported, but she possesses other raw materials such as kaolins, clays, etc., in addition to poor quality bauxite which could be used. The cost of raw material, however, is only a fraction of the total cost of production, and the processing of such inferior raw material would prove much more expensive than that of high-grade bauxite.

A number of alternate processes for aluminium production have been proposed, but the majority have met with little success. Among these are the well-known Pederson and Haglund processes. The Pederson process is now over 13 years old and is in use in a plant of Norsk Aluminium Company at Hoyanger. Briefly it consists in adding the aluminous raw material—such as ferruginous bauxite—to the ordinary iron smelting charge in the blast furnace, when pig-iron low in sulphur and a calcium aluminate slag are obtained. This slag must then be treated by the Bayer process so that, in addition to new limitations and difficulties, the main cost factors of the Bayer process remain. Great hopes were expressed for the Haglund process, and the Lautawerk spent much on a large-scale experimental plant, but finally gave it up. In this process a mixture of clay, coal and pyrites is melted in an electric furnace, yielding an iron-silicon alloy and a slag consisting of a solution of alumina in aluminium sulphide. On cooling, the alumina separates from the slag and can be separated from the sulphide either mechanically or chemically but, although this process avoids the difficulties and expense of the Bayer process, a number of new difficulties arise.

In the case of siliceous raw materials such as kaolins, clays, etc., the so-called acid processes as the Nuvalon process of Buchner and the S.T. process of T. Goldschmidt A.G., Essen, seem most promising. In the Nuvalon process the ground, dehydrated clay is extracted in autoclaves with 25 per cent. nitric acid at 150° C. and, if excess clay is used, only a little iron goes into solution. After filtration the solution is allowed to crystallise, yielding aluminium nitrate with 14 per cent. alumina which may be treated in one of two ways. In the first method the crystalline nitrate is fused and then

decomposed at 400 to 500° C. The nitric acid is driven off, partly decomposed, and is collected and regenerated. In the second method it is suggested that the nitrate solution be neutralised with ammonia to yield ammonium nitrate which can be sold as a fertiliser. This process, however, failed previously when large-scale experiments were tried owing to the difficulty of finding containers capable of resisting the attack of the nitric acid corrosion and because of the unavoidably high loss of nitric acid. On the other hand the S.T. process has been so developed that at present large amounts of clay are treated at the Lautawerk with satisfactory commercial results. The alumina produced is more expensive than that obtained from bauxite by the Bayer process, but the same plant can be adapted without much difficulty so that it is possible to change from bauxite to clay at any time. The calcined clay is crushed to the size of hazel nuts and is digested with dilute sulphurous acid solution at a temperature of 50 to 60° C. and a pressure of about 7 atmos. An aluminium sulphite solution with iron, silica and titania as impurities is obtained, but if this is heated at from 80 to 100° C. basic aluminium sulphite with about 29 per cent. of alumina is precipitated, the impurities remaining in solution. The basic sulphite is calcined to alumina, the sulphurous acid driven off being used again. This alumina, however, is too impure for the production of high-grade aluminium and is therefore redissolved in soda lye and treated by the Bayer process. Sulphurous acid is the cheapest commercial acid, and this process is therefore the most economical of those so far suggested and tried for the production of alumina from native raw materials.

It is apparent that no reduction in the cost of production of alumina can yet be expected and, at present, little reduction in the cost of current and electrodes is possible. It has often been suggested that electrolytic production of light metals entailing the production of expensive intermediates should be abandoned, and a return made to the thermal reduction of the metallic oxides by carbon, the usual metallurgical practice with heavy metals. In the case of alumina and magnesia, however, the reduction temperature is so high (1,800° to 2,200° C.) that it can only be attained by means of the electric-arc furnace, and at such temperatures the metals and their oxides are volatile. This means that the metal reduced from the oxide is set free in the form of vapour and, with the carbon monoxide, forms a phase from which the metal has to be separated by condensation. If the vapour phase is cooled in order to condense the metallic vapours, they react with the carbon monoxide, so that the final product is an undesirable mixture of metal and oxide. In the case of aluminium, alumin-

ium carbide is formed and this unites with alumina and aluminium to form a ternary melt. The one-stage thermal reduction of bauxite or clay is therefore impossible, but suggestions have been made that the raw material be reduced electro-thermally to an aluminium-silicon-iron alloy and then refined electrolytically to pure aluminium, or oxidised selectively to alumina and an iron-silicon alloy, or reduced with sulphur to aluminium sulphide which can then be electrolysed. These ideas, however, must be further developed before their industrial value can be judged. It has also been suggested that the possibilities of the electrolysis of molten aluminium chloride be investigated; at present the Clausthal Akademie has undertaken such researches. The decomposition voltage of the chloride is only about one volt lower than that of the oxide, and in a chloride electrolysis there is only a small consumption of electrode carbon, so that, theoretically, costs might be reduced by about 20 per cent. in the electrolysis of the molten chloride. Further, the production of anhydrous pure aluminium chloride from clay using the by-product chlorine from such an electrolysis could result in a much cheaper material for electrolysis than alumina.

Treatment of Ferruginous Bauxites.—Deposits of ferruginous bauxite, containing over 26 per cent. of ferric oxide, are common, but the commercial uses of the material are limited, owing to its high iron content. A simple method of partially purifying such bauxites would be of value owing to the increasing demand for bauxite as a raw material for aluminium, and a recent paper by C. G. Fink and V. S. de Marchi (*Trans. Electrochem. Soc.*, 1938, **74**, 509 [preprint]) is of interest in this connection. The authors have studied various chlorination treatments which have been proposed for improving the quality of ferruginous bauxite and have devised a suitable process for the purpose.

The methods investigated included treatment of the heated bauxite with chlorine mixed with carbon monoxide, hydrochloric acid or sulphur chlorides, and also the action of chlorine on a heated mixture of bauxite and carbon. Tests indicated that these methods were not readily adapted to different types of bauxite, and owing to the low rate of reaction and the consequent loss of alumina, they were not commercially practicable. The addition of hydrogen sulphide to the chlorine used increased the rate of reaction although it did not reduce the loss of alumina.

The most promising results were obtained by mixing bauxite with an excess of powdered sulphur, and heating, with exclusion of air, until the excess sulphur had volatilised. Most of the iron was converted into sulphide by this treatment,

the other oxides not being attacked. On passing chlorine over the heated residue from the sulphur treatment, iron rapidly volatilised as chloride, the other main impurities, titania and silica, being also partially removed as chlorides.

As an example of the success of this process, a sample of bauxite from Istria (Italy) which contained 29 per cent. of ferric oxide was treated at 600° C. with chlorine, after a preliminary sulphur treatment, and 90 per cent. of the total ferric oxide, over 50 per cent. of the titania, and 14 per cent. of the silica, were removed. The alumina loss was only 9 per cent. and the chlorine reaction was complete within five minutes. The behaviour of different types of bauxite when submitted to this process were studied and the effect of modifying the particle size of the treated material and the rate of flow of chlorine ascertained.

Diamond Cutting Industry in Palestine.—According to a recent issue of the *Crown Colonist* (May 1938, p. 327) a diamond cutting industry has been established in Palestine by Jewish experts from Antwerp. There are now two workshops employing 100 people, one in Petach Tikva and the other in Tel-Aviv, where rough-cut diamonds are cut to final shape, polished, etc. Two new workshops are to be opened in Tel-Aviv, which will work with raw stones.

Zirconia as a Constituent of Glasses.—Although the use of zirconia as an opacifier in enamels is well known, its possible applications in the manufacture of glasses have received little attention. An article by E. Preston in *Foote-Prints*, December 1938, summarises the results of work which has been carried out on the uses of zirconia as a constituent of glasses and points out the valuable properties of such glasses. W. E. S. Turner and his co-workers (*Trans. J. Soc. Glass Tech.*, 1926, **10**, 304 and 1927, **11**, 52) studied the properties of soda-zirconia-silica glasses of various compositions and found them to be very resistant to chemical attack, especially by alkaline reagents. The addition of zirconia was also found to increase the viscosity of the melt, to raise the specific gravity and the annealing temperature of the glass and to decrease the coefficient of expansion.

More recently Horak and Sharp (*J. Amer. Ceram. Soc.*, 1935, **18**, 281 and 282) studied the effect of substituting zirconia for alumina in borosilicate glasses of the heat-resisting type and found that when all the alumina was replaced by zirconia the resistance to attack by boiling water was increased five-fold. They also investigated the effect of the addition of zirconia on the elastic moduli of typical soda-lime-silica glasses and

reported that such additions increased the impact strength and thermal endurance of the glass.

Gauge tubes for boilers are now being made of zirconia glass and have proved to be very resistant to corrosion by alkaline boiler waters. The present low market price of zircon, which can be obtained in grades pure enough for use in glass manufacture, opens up possibilities of further practical applications of such glasses.

Mineral Wool.—An interesting contribution by J. R. Thoenen on the manufacture of mineral wool and its use for insulating purposes particularly in house construction appears in the February issue of *Mining and Metallurgy.*

During 1928 there were 7 producing companies in the United States with an annual output of 50,000 tons, whereas in 1936 there were 50 companies producing 500,000 tons annually with a value of $30,000,000. The industry is still growing and is expected to derive profit from the building activity of 1939.

Natural mineral wool was discovered on Hawaii in 1788 by a group of United States scientists who observed that it was formed in the crater of the volcano Kilauea by jets of steam blowing through molten lava ; the local folklore ingenuously explained the phenomenon by picturing the goddess Pélé, when angry, pulling out her hair by the handful.

Little attention was paid to the process of manufacture devised as a result of this discovery, until in 1840 it was reported produced in Wales and later in Germany. In November 1888 an article in the " Stone " magazine described its manufacture in Cleveland and in 1893 a dress made from silica wool was exhibited in Chicago. In 1897, C. C. Hall in Alexandria, Indiana, produced rock wool as a commercial undertaking.

The generic term " mineral wool " includes a number of products differentiated by the raw materials from which they are manufactured. Rock wool utilises limestones, clays and quartz or sandstone ; slag wool is made from iron, lead or copper slags together with limestone or silica ; and glass wool is made basically from soda ash, limestone and silica.

In the normal method of manufacture the raw materials are mixed with alternate layers of coke in a water-jacketed steel cupola. The charge is melted by igniting the coke and the resulting slag is tapped through a small aperture. The issuing molten stream is disintegrated at a point in its descent by a powerful cross jet of steam, fine threads being produced.

Various technical difficulties are encountered in the manufacturing process such as the production of " shot " which is that part of the initial globular material which has cooled and

solidified before being drawn into fibre. The presence of this reduces the insulating capacity of the wool.

The temperature of melting and blowing, the diameter of the molten stream and the length of fall from draw hole to steam jet are all variables affecting the successful production of wool. The melting temperatures range from 2,300° F. to 3,400° F. and the temperature of the molten stream when cut by the steam jet ranges from 2,000° F. to 2,850° F.

For efficient insulation the diameter of the fibre must be as small as possible, and manufacturers try to keep it between the limits of 4 to 10 microns, i.e. ·00016 to ·0004 in. The fibres must also be as long as possible to increase the strength of the finished product.

The wool is blown direct by the steam jet into a wool room with a moving belt-conveyor floor which carries the wool out as a blanket of uniform thickness. This is then cut up into sizes suitable for use in house insulation. Wool to be used for other purposes is granulated and has the "shot" removed. It may then be blown into the walls of existing houses, or it may be mixed with binders and moulded into insulating board, pipe covering and other shapes. When mixed with clay (or bentonite) and asbestos it is sold as an insulating cement. It may be placed between wire netting and used as insulation in furnace walls and ducts; it may also be used in railway cars and annealing ovens, and made up into sizes for stoves and refrigerators.

The conductivity of mineral wool used in house insulation is found to be approximately 4 times lower than that of yellow pine wood, 9 times lower than common plaster, 15 times that of brickwork and 32 times that of concrete. The disadvantage of the wool when used for house insulation is that it is very prone to absorb and retain moisture. This may be overcome by covering it suitably with damp-proof paper. Some mineral wools are subjected to a moisture proofing process, but this is insufficient to prevent the adsorption of all moisture.

The following table shows the heat loss from a typical American house under specified conditions, and indicates the fuel saving equivalent of rock wool insulation.

House with	Heat loss (*B.Th.U.*).	Equivalent tons of coal.
No insulation .	38,000,000	1·6
1 in. rock wool .	18,700,000	0·8
3⅝ in. rock wool .	8,600,000	0·4

Transvaal Vermiculite.—The vermiculite deposits in the Palaboroa Area, North-east Transvaal, are described in a bulletin (No. 11) of that title by C. M. Schwellnus; a brief account taken from an abstract kindly forwarded by Dr.

Haughton, Head of the Geological Survey of the Union of South Africa, is appended. Numerous deposits of vermiculite are known in the Transvaal, the largest being in the Palaboroa Area some 25 miles north-east of Mica Siding on the Salati Railway. The mineral has a yellowish-brown colour and bronze-like lustre, and the cleavage laminæ are usually soft, pliable and inelastic. The deposits, which constitute the largest in the Union, occur as masses, lenticular bodies of irregular shape, bunches, pockets, discontinuous streaks and disseminations. The quantity available can safely be reckoned in millions of tons. It has been tested by the Geological Survey, Pretoria, and by the Minerals Research Laboratory, Johannesburg, and found to be of good quality.

It is understood that the deposits are being opened up and trial shipments have been sent to firms in the United Kingdom and France.

BOOK REVIEWS

Books for review should be addressed to " The Editor," Bulletin of the Imperial Institute, South Kensington, London, S.W.7.

The Birth and Development of the Geological Sciences. By Frank Dawson Adams, Ph.D., D.Sc., F.R.S. Pp. v + 506, 10 × 7. (London: Bailliere, Tindall & Cox, 1938.) Price 22*s*. 6*d*.

Geology as a science was long delayed in achieving precise formulation, and when exact status was attained in the early nineteenth century a period of almost 2,500 years had elapsed in which a diversity of both wild speculation and casual observation had accumulated.

The interesting and often diverting writings of this phase in geological history are the sole concern of Dr. Adams, who confesses that the prolific growth of geological surveys, societies and literature subsequent to 1825 could not adequately be contained in one volume of ordinary dimensions.

A small measure of criticism may be directed against the irrelevancy of much of Chapter II on classical references, many of which are not geological topics; but Theophrastus' treatise *Concerning Stones* (a remnant of a larger work), Strabo's *Geography*, Vitruvius' *De Architectura*, and Pliny's *Natural History* are certainly contributions essential to any historical account of the science.

A conspectus of the earliest days of geology having been

given, the author advances to the medieval conceptions of cosmography and related occult beliefs (Chapter III), and thence to the theories which have prevailed since Aristotle as to the mode of generation of stones (Chapter IV). Certain of these now fantastic notions are particularly strange, though understandable, and mention may be made of the crystallisation from sea water of columnar basalt as at Giant's Causeway, and of sea-shore sand generally, as well as Avicenna's theory that the Stone-Age implements found in certain localities in Europe were of celestial origin, a report which became current in Germany where they became known as "donneraxten."

Mineralogy in medieval times is summarised in Chapter V, and traced to the days of Aldrovadus, then in the following chapter an account is given of the birth of modern mineralogy, a science which owes its inception to the mining for ores in Saxony. An excellent account is given here of the life and work of that eminent early mineralogist, Georg Bauer, known as Agricola, whose treatise *De Re Metallica*, published in 1556, a year after his death, represents one of the most valuable contributions to mining and mineralogical literature.

The succeeding section of the book is devoted to the birth of historical geology and the rise and fall of Werner's Neptunian theory which was displaced largely by the work of Hutton at Edinburgh, who with his adherents were known as Plutonists. Hutton's original work entitled *Theory of the Earth with Proofs and Illustrations* was published in 1795 in two volumes with a reference to a third, a part of which it is of interest to note Dr. Adams claims to have discovered in 1899 in the library of the Geological Society of London. The radical soundness of Hutton's observations and theories tolled the knell of the Neptunists, amongst whose ranks even Göethe was to be found.

The course of the volume now turns to special topics such as "figured stones" and palæontology (Chapter VIII); the origin of metals and their ores (Chapter IX); the origin of mountains; earthquakes; the origin of springs and rivers; quaint stories and beliefs; and, retrospectively, a conclusion (Chapter XIV).

Broadly repetitive though this work may be, the wealth of interest afforded the student of the growth of geology, the engaging prose style of the author, and the pleasing woodcuts and plates, warrant its inclusion amongst the standard literature of the science.

GEOLOGY OF INDIA. By D. N. Wadia, M.A., B.Sc. Second Edition. Pp. xx + 460, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: Macmillan & Co., Ltd., 1939.) Price 24*s*.

The progress of Indian geology during the 20 years which have elapsed since this book first appeared (reviewed in this

BULLETIN, 1919, **17**, 450) has necessitated a thorough revision of the text and the incorporation of much recent information in the present edition. The length of the book has been increased by 62 pages and the text has been still further increased as the marginal paragraph headings have been dropped, which allows of more print per page. A new and welcome feature is a coloured geological map of India, including Burma, on the scale of 96 miles = 1 in.

The subject is treated in stratigraphical sequence, each formation being dealt with in considerable detail, including its igneous rocks. The economic geology of India occupies a chapter of 55 pages in which the entire range of metalliferous ores, coal, petroleum, and other economic minerals as well as water, building materials, soils, etc., are considered.

The value of this useful book lies in its comprehensive treatment of the subject and the numerous references to the original literature. In the detailed text, however, there are certain inaccuracies, some of which have been carried over from the first edition.

PUBLICATIONS DU BUREAU D'ÉTUDES GÉOLOGIQUES ET MINIÈRES COLONIALES. No. 10. Sur la composition et l'attribution au Jurasso-crétacé de la série schisteuse du maïo Lidi (Cameroun septentrional), par René Van Aubel; Sur les roches du soubassement de la région entre Bangui et le Cameroun, par V. Babet. Pp. 43, 10 × 6½. Price 15 francs. No. 12. Étude des Altérations superficielles; Application à l'Exploration géologique et minière. Pp. vii + 112, 10 × 6½. Price 30 francs. (Paris: Bureau d'Études Géologiques et Minières Coloniales, 1939.)

Publication No. 10 of this series is in two parts, the first of which shows that the schistose rocks of the river Lidi, formerly attributed to the Jurassic and Cretaceous, belong to the Muva-Ankole Series as defined by the Kigoma Conference. Like the Muva-Ankole of other parts of Africa, the deposits are intruded by granitic rocks with which are associated gold occurrences.

The second and longer part of the publication deals with the basement rocks in that narrow strip of French Equatorial Africa running between the Cameroons and the Belgian Congo, and is the work of the Government Geologist. The rocks are classified into three main groups: a granito-gneissic complex, a schisto-quartzitic series, and volcanics. These are subdivided into numerous smaller groups, all briefly but adequately described, and accompanied by chemical analyses and norms. The report concludes with a short section on tectonics and a geological map on a scale of 1 : 500,000.

In publication No. 12 various experts have discussed surface alterations in their different aspects and in their relation to geology and agriculture. M. H. Erhart contributes the first somewhat general section on the mode of formation of some of the principal types of tropical soil. The mechanism of the formation of laterite is examined with great care as it is considered to explain the origin of bauxite deposits and in some cases of iron ore deposits. Four chief types of soil are described: podsol, tchernozem, lateritic forest soil and true laterite. The principal characteristics of the soils are summarised as well as their agricultural possibilities.

In the second section M. Agafonoff shows the application of the general principles of soil science to a particular case and gives a concise account of the results of intensive work on the soils of Tunisia, the chief types of soil found in the Colony being described and mapped.

The following two chapters by geologists, MM. H. Hubert and J. Lombard, show the relation of surface alteration products, especially different types of laterite, to the nature of the substratum, and indicate their applications in mining and geological work in French West Africa and French Equatorial Africa respectively.

The final section, written by M. H. Besairie, deals with the weathering of rocks and the formation of soils in Madagascar, the effect of various factors such as relief, nature of parent rock, rainfall and vegetation being considered briefly. A short description of the varied results of weathering of the parent rocks under the influence of these factors follows, the alterations being shown to be mainly in the direction of lateritisation. Some specific indications are given of the possibility of making deductions applicable for use in mining and prospecting from surface data as applied to Madagascar, as well as a short account of the uses of the main types of soil.

Each author appears to have been left free to write his own section and no attempt at correlation has been made. In consequence, the views expressed in different sections, e.g. on the definition of laterite, are not uniform. This, however, serves to emphasise the various deductions which can be made from similar data, and to show that it is difficult, if not impossible, to form definite conclusions.

DISRUPTED STRATA. Faulting and its Allied Problems from the Standpoint of the Mine Surveyor and Stratigraphist. By M. H. Haddock, F.G.S., A.M.I.M.E. Second Edition. Pp. xvi + 104, 9¾ × 6¼. (London: The Technical Press, Ltd., 1938.) Price 16*s*.

The second edition of Mr. Haddock's excellent treatise on stratigraphical dislocations makes a welcome appearance, and

further improves the utility to the mine surveyor and cartographer of a concise mathematical consideration of faulting.

A considerable degree of enlargement is generally evident throughout the book, which, however, follows the same lines as the first edition in proceeding from borehole problems relating to the disposition of planes, and parallel and strike fault movements, to fundamental formulæ for pure and common thrusts, location of the disrupted member of an earth displacement, rotational faulting, and the driving of cross measures headings (drifting).

The book contains a valuable bibliography and a subject index, and affords an excellent guide for the student of mathematical tectonics.

MANUAL OF SEDIMENTARY PETROGRAPHY. By W. C. Krumbein and F. J. Pettijohn. Pp. xiv + 549, 9 × 6. (New York and London: D. Appleton-Century Company, Inc., 1938.) Price 30*s*.

During the last twenty years there has been a notable increase in the interest taken in this branch of geology, and to-day the closely related sciences of sedimentary petrography and sedimentary petrology are established on a firm basis of technical procedure and deductive theory.

The book is primarily concerned with the methods of petrographic analysis of the sedimentary rocks, including the unconsolidated sediments, and is claimed to cover every step of the process, from the field sampling to the final graphic and statistical analysis.

The work is divided into two parts. The first, by W. C. Krumbein, deals with sampling, preparation for analysis, mechanical analysis, and statistical analysis; the second, by F. J. Pettijohn, deals with shape analysis, the methods of separation, mounting, and identification of minerals, description of the minerals, estimation of mineral frequencies, chemical methods of study, and the mass properties of sediments. The book concludes with a chapter on the laboratory, together with useful lists of equipment and reference books.

The treatment of the numerous sub-divisions of the subject is not only comprehensive but often detailed and includes a certain amount of mathematics. In such a work of reference the chapter which is likely to be consulted more than any other, especially by the student, is that where the minerals are described. This chapter, though good as far as it goes, is neither so comprehensive nor so detailed as the others. A number of additional minerals might have been described with advantage, and the illustrations of grains, though well done, do not always cover a sufficient number of varieties of

each species. No description is given of the various types of sedimentary rocks, nor are there any special sections dealing with the principles of correlation, questions of provenance, or palæo-geographical problems.

In short, a great deal of valuable information not to be found in other textbooks has been carefully assembled to form the bulk of the book, those parts of the subject already adequately treated elsewhere receiving less attention or being omitted. While, therefore, this is an invaluable addition to the literature on the subject it should be used in conjunction with existing texts.

ALLUVIAL PROSPECTING AND MINING. By S. V. Griffith. Pp. x + 142, $8\frac{3}{4} \times 6$. (London: Mining Publications, Ltd., 1938.) Price 12*s.* 6*d.*

This is a useful elementary textbook designed to help the young engineer over some of the stumbling blocks of placer mining. The subject matter is conveniently brought together in seven chapters dealing with prospecting methods, water supply, sluicing, hydraulic mining, gravel pumping, miscellaneous mining methods (including the use of drag-line excavators and power shovels), and alluvial diamond mining. No reference, however, is made to dredging, the most important method of alluvial mining, as the author is of the opinion that the subject is too large to be discussed in a book of this type. Nevertheless, the omission is to be regretted.

Throughout the work the author has employed the formulæ given by A. A. Barnes for the calculation of discharge of weirs, flumes, pipes, etc. He has, moreover, laid special emphasis on sluicing, which is not only the simplest but one of the cheapest methods of working shallow gravel placers; indeed, 27 pages have been devoted to this subject, as the author maintains that a knowledge of the principles of sluicing is required both for hydraulic mining and gravel pumping.

The account given of the working of alluvial diamond deposits ($7\frac{1}{2}$ pp.) is a novel feature in a textbook on alluvial mining and doubtless will be appreciated by the student.

The work contains 17 statistical tables and 117 illustrations, including half-tone plates and line-drawings.

PRINCIPLES OF FLOTATION. Ian W. Wark, Ph.D., D.Sc., Pp. 346, 9×6. (Melbourne: Australasian Institute of Mining and Metallurgy (Inc.); London: The Technical Bookshop, 1938.) Price 21*s.*

This monograph is essentially a progress report of work carried out on the principles of mineral flotation at the Flotation Research Laboratory of Melbourne University. The

Laboratory, which is under the supervision of Dr. I. W. Wark, maintains close contact with the non-ferrous mining industry, and is financed jointly by Zinc Corporation Ltd., Broken Hill South Ltd., North Broken Hill Ltd., Mount Lyell Mining and Railway Co. Ltd., Burma Corporation Ltd., and the Electrolytic Zinc Company of Australasia Ltd.

The work is divided into thirteen chapters, the first of which gives a broad survey of the principles underlying the early processes of flotation, and of the gradual development of present-day processes from them. The section is concluded by the observation that only thirty years have elapsed since flotation first became a commercial undertaking and that it is unlikely that the best possible reagents and conditions for flotation have yet been discovered. It is indeed probable that more specific reagents will be found in the future.

The variables of flotation, the physical principles involved in various flotation processes, an account of experimental methods suitable for the plant metallurgist, and a classification of flotation reagents form the subject matter of the following four chapters. Next follow two chapters on the flotation of sulphide minerals by collectors of the xanthate and non-xanthate type.

Chapters 8 and 9 deal with activation and depressants, Chapter 10 with collectors for non-sulphide minerals, and the last three chapters with frothing, the influence of colloids on flotation, and the electrical properties of surfaces in relation to flotation.

The work as a whole is excellently devised, and the Council of the Australasian Institute of Mining and Metallurgy is to be congratulated on the publication of a valuable treatise regarding a subject which has definitely revolutionised modern mining and ore-dressing.

FLOTATION PLANT PRACTICE. By Philip Rabone, A.R.S.M., D.I.C., Assoc.Inst.M.M. Third Edition, revised and enlarged. Pp. xiii + 184, $8\frac{3}{4} \times 6$. (London: Mining Publications, Ltd., 1939.) Price 12*s*. 6*d*.

Recent advances in the theory of flotation have justified the new edition of this volume, the first two editions of which were reviewed in this BULLETIN, 1933, **31**, 132, and 1936, **34**, 429.

The notable feature of this edition is the chapter on flotation reagents, which has been rewritten and now contains an explanation of the so-called chemical theory of flotation. This suggests that the sulphide minerals take up oxygen from the aerated pulp to form, say, a soluble sulphate, which then reacts with the alkali-metal xanthate, by double decomposition, forming an insoluble heavy metal xanthate, which is water

repellent and floatable. This chapter now includes a short bibliography.

A section on the separate treatment of middling products and a description of the flotation of non-sulphide minerals, e.g. limestone and pebble phosphates, has been included in the chapter on flotation methods. Flotation has been found to be the only suitable method for removing excess silica and alumina from certain limestones used in cement manufacture.

Descriptions of recent types of plant are given, the text-figures including diagrams of an American type of subaeration machine and a new counter-current flotation machine. The table of factors for calculating the capacity of conditioning tanks and machines has been revised.

The book continues to give a useful outline of the general aspects of flotation theory and practice.

ENGINEERING METALLURGY. By Bradley Stoughton, Ph.B., B.S., and Allison Butts, A.B., B.S. Third Edition. Pp. ix + 525, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1938.) Price 24*s*.

The rapid progress which has taken place in the metallurgical industry has made this third edition of *Engineering Metallurgy* necessary.

Amongst the many new features incorporated, special mention may be made of Chapter 15, devoted to the application of metals to automobile manufacture, railways, machine design, and structural purposes, which presents an outline, rather sketchy it must be admitted, of modern metallurgical requirements in these branches of engineering. The value of this innovation, however, has been reduced by faulty literary construction and, in places, obvious inaccuracies, e.g. the statement on p. 451 that "Cost does not permit aluminum or aluminum alloys to be used for the low- and medium-priced cars" but in road transport vehicles their employment is warranted because they "decrease the dead-load and correspondingly decrease the pay load."

Apart from this particular chapter the book continues to provide a reasonable summary of an inordinately large field of knowledge.

METALS. By Sir Harold Carpenter, M.A., A.R.S.M., Ph.D., D.Met., D.Sc., F.R.S., and J. M. Robertson, Ph.D., D.Sc., A.R.T.C. Volume I. Pp. xxii + 823. Volume II. Pp. xii + 825-1485, 9¾ × 6½. (London, New York, Toronto: Oxford University Press, 1939.) Price 105*s*. the two volumes.

The science and practice of metallurgy have progressed vastly since the not-so-distant days when the former was

virtually non-existent and the latter represented solely by the struggling works of local iron-masters and brass-founders. Such phenomenal advance as has been witnessed, particularly in the past two decades, called forth a spate of textbooks more often than not devoted to some specialised aspect of the industry and broadly divisible into ferrous and non-ferrous relationships, but a work of the calibre of that under review treating as it does of almost the entire gamut of fundamental metallurgy, represents an epoch even in these days of literary profusion.

The two volumes, which are composed of six parts, are concerned not so much with the extensive and varied applications of metals as with the intrinsic properties which condition their behaviour in post-smelting treatment and subsequent service ; the mode of presentation is such as to enable a reader possessing scientific but no metallurgical training to acquire a fairly comprehensive knowledge of the subject by progressive reading.

Volume I is prefaced by a short introductory chapter covering such topics as the relative importance of metals and alloys, the occurrence of ores and their mining, concentration and smelting, and a world production table of the industrially important metals, which regrettably, in giving statistics only for the years 1929, 1934 and 1935 does not reflect the rearmament boom in metals. Metallurgy proper is considered in the succeeding ten chapters of Parts Nos. I to IV which constitute the bulk of this volume, and are devoted successively to microstructure, crystal structure, deformation and fracture of metals ; alloys ; properties of metals ; and the treatment of metals.

The authors have indulged in quite a degree of digression from strict metallurgy in this volume, mainly in Chapter II on the structure of pure metals, and discuss such topics as crystal lattices, microscopy, the periodic classification and valency. In considering the effect of polishing on metallic surfaces it is pointed out that in the final stages of cloth buffing the superficial layers of the metal undergo flowage and assume a sub-crystalline or amorphous state, usually to a depth of 30 Ångström units. It may be cited that in ore-microscopy which entails a high degree of cloth polishing calculated to induce intensive flowage, examination of minerals by polarised light apparently reveals no amorphous condition masking the basic crystalline disposition of the mineral, and no random orientation of minute crystals.

The succeeding two chapters on deformation and fracture, and time, temperature and deformation, which complete Part I, follow the normal lines of treatment of the mechanism of elastic and permanent deformation of metals under stress and strain, and the influence of time and temperature factors.

Part II is devoted entirely to alloys, their solidification,

structure and constitution, and changes in the solid state, particularly the deposition of carbon in the form of Fe_3C when γ-iron is cooled and transforms to the α-phase. The precipitation of such a phase along crystallographic planes gives rise to the structure observed in meteorites in 1808 by Alois de Widmanstätten and named after him.

The properties of metals form the thesis for Part III. The first chapter (VII) discusses mechanical tests such as tensile stressing; the various hardness trials including Brinell, Rockwell and Vickers; notched-bar impacts; creep; and fatigue trials. Oxidation and corrosion in non-ferrous alloys as well as in iron and steel are dealt with in Chapter VIII, the concluding one of this section, and much attention is paid to the electrochemical aspect of the problem.

Having considered the inherent properties of metals and alloys, the authors devote two chapters to effects of casting and heat treatment (Part IV) and provide an excellent summary of modern technique mainly in the moulding, annealing, and hot and cold working of iron and steel.

The second volume is concerned largely with industrial ferrous alloys (Part V), and to a lesser extent with the non-ferrous alloys (Part VI). The topics discussed in Part V include the mode of crystallisation of the iron-carbon alloys, including the suppression of normal phases (ferrite and pearlite) and the retention of such phases as austenite by rapid cooling through the A_1 point (at 725° C. and 0·87 per cent. carbon); the effects of heating such alloys are also considered. These subjects form Chapter XI; the succeeding three chapters, constituting the remainder of the Part, treat of the rôle of minor constituents in irons and steels, inherent grain size, the classification of steels, and the cast irons.

Much of the final Part is devoted to copper and its alloys (Chapter XV), but the last chapter covers other such important alloying metals as aluminium, nickel, lead, zinc, tin and magnesium.

Viewed by and large this book with its wealth of excellent plates and figures, list of references, and author and subject indexes, represents the most comprehensive general textbook on metallurgy which has appeared in this country in recent years, and must prove of no small value both to the student and the practising metallurgist.

ALUMINUM. Its History, Metallurgy, and Uses, with Projects for the School and Home Shop. By Douglas B. Hobbs. Pp. vii + 295, 9 × 6. (Milwaukee, Wisconsin, U.S.A., 1938.) Price $3.00.

The author of this book states in his preface that it is his purpose to provide the student with a textbook on aluminium

which will enable him to obtain basic principles without becoming involved in details, and in this he has achieved a considerable measure of success.

Part I devotes 176 pages to the history, metallurgy, and uses of aluminium. The history of the metal is dealt with in a chapter of nine pages and the manufacture in one of eleven pages. This latter chapter deals very briefly with the mining of bauxite, the preparation from it of alumina by the Bayer process, and the electrolytic production of aluminium by the Hall-Héroult process. The remaining seven chapters of Part I deal with the casting of aluminium alloys, the manufacture of such basic wrought commodities as plate, sheet and foil, bar, rod, and wire, etc., the physical and chemical properties of aluminium and its alloys, forming and machining, joining, finishes and applications. Here the author has borne in mind the limitations of the school or home workshop ; for example, it is quite possible to produce sand castings in such shops and so the sections on sand casting are more detailed than those on die and permanent-mould casting, although in all three cases the principles involved in the manufacture of the casting have been covered.

In Part II, which comprises 110 pages, directions and drawings are given for the preparation in a home or school workshop of 25 aluminium articles of graded difficulty.

The alloy nomenclature employed throughout is that of the Aluminum Company of America.

The printing, binding, and particularly the illustrations are of a high standard, there being 203 photographs and diagrams in all. Its limitations and elementary nature, however, are fully recognised by the author, who suggests more voluminous works such as *The Aluminum Industry*, by Edwards, Frary and Jeffries, for the advanced study of aluminium.

THE STONE INDUSTRIES. By O. Bowles. Second Edition. Pp. xiii + 519, 9 × 6. (London : McGraw-Hill Publishing Company, Ltd., 1939.) Price 30*s*.

The second edition of this well-known textbook on stone industries is largely a reprint of the first which was noticed in this BULLETIN, 1934, **32**, 630. The arrangement of the subject matter, the illustrations, bibliographies, and footnote references remain unchanged, but some of the statistical tables have been revised to include figures for 1936 and 1937, those for 1931 to 1935 inclusive being omitted. In other cases, the figures for 1929 and 1930 are quoted as being more typical than those for the omitted years, a statement which is hardly

justifiable in view of the economic conditions of the last decade.

In the absence of an up-to-date English treatise on the production, treatment and uses of stones, this work, although devoted primarily to American occurrences, will doubtless be regarded as the standard textbook dealing with the principles of the stone industry.

A MANUAL OF RADIOACTIVITY. By George Hevesy and F. A. Paneth. Second Edition, completely revised and enlarged. Translated by Robert W. Lawson. Pp. xvi + 306, 9 × 6. (Oxford: Oxford University Press; London: Humphrey Milford, 1938.) Price 17*s.* 6*d.*

The need for a general students' textbook on radioactivity instigated the publication of this Manual first in German (1923), then in English (1926), and again in German (1931). The popularity and soundness of the work are vouched for by this second English edition, which in accordance with the authors' established practice is no mere literal translation, but a complete revision of the text in the light of subsequent progress.

A large amount of rearrangement has been made to the basic text retained from the first English edition. Many new sections have been added, and others transposed, but the general order still proceeds from a consideration of radioactive principles through dissertations on the α, β and γ rays, etc., the atom, atomic disruption, radioactive elements, isotopy and the effects of rays from radium, to the geological and physico-chemical significance of radioactivity. The new chapters deal with positrons and neutrons (Chapter VII) and the transmutation of the elements by nuclear disruption with α and β rays and the impact of neutrons (Chapter X); Chapter IV on the atomic nucleus and Chapter XIX entitled the "Isotopy of Elements which are not Radioactive," are also essentially new. Of the sectional additions the more important are those dealing with quantum and wave mechanics, the application of the radioactive elements to physical, chemical and biological investigations, and the diffusion method for the separation of isotopes.

The letterpress has been much improved by heavy type sub-headings in the chapters, and a resetting of certain tables has also added to the clarity of the book. Further improvements to the work include select references at the close of each chapter, and the inclusion of an appendix on the cyclotronic method of generating high-energy ion beams.

In a worthy endeavour to cover an ever-rapidly expanding

field, one feels, however, that the authors have erred slightly in adopting a terse style of writing which, in translation, although readily understandable to the expert, makes the lot of the student somewhat difficult.

SOIL ANALYSIS. By C. Harold Wright, M.A., F.I.C. Second Edition. Pp. x + 276, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: Thomas Murby & Co.; New York: D. van Nostrand Co., Inc., 1939.) Price 12*s*. 6*d*.

The first edition of this book was reviewed in this BULLETIN, 1934, **32**, 337, and it was then suggested that in view of the rapid developments taking place in the study of soils, early revision was likely to become necessary. The numerous alterations and additions which have been made in the second edition show that this suggestion was well founded.

The present edition follows in general the lines of the previous one. The whole text has, however, been carefully revised and a number of new methods added, but by condensing many passages and omitting methods which were out of date or of minor importance, it has not been found necessary to increase greatly the size of the book. The chief additions include the determination of the freezing point of soils, the use of the glass and the antimony electrodes, the examination of inorganic soil colloids and the determinations of zinc and cobalt in soils. The sections on the determination of calcium and of exchangeable potassium have been rewritten and the useful so-called tri-acid method for clay analysis, the application of which to soil clays was worked out at the Imperial Institute by Miss R. C. Groves, M.Sc., F.I.C., is given in detail.

In the revision of the methods of mechanical analysis, the latest recommendations of the International Society of Soil Science have been followed. Descriptions of Schollenberger's method for determining carbonates and of some rapid titration methods have been added.

The bibliography of standard works on soil analysis and related subjects has also been brought up to date.

This new edition should continue to be of considerable use to all those interested in the chemical and physical analysis of soils.

BOOKS RECEIVED FOR REVIEW

MONOPOLY AND COMPETITION IN THE ENGLISH COAL TRADE, 1550-1850. By Paul M. Sweezy. Harvard Economic Studies, Volume LXIII. Pp. xii + 186, $8\frac{1}{2} \times 5\frac{3}{4}$. (Cambridge, Mass., U.S.A.: Harvard University Press; London: Humphrey Milford, Oxford University Press, 1938.) Price 10*s*. 6*d*.

TANKER FREIGHT RATES AND TANKSHIP BUILDING. By Dr. T. Koopmans. Netherlands Economic Institute, No. 27. Pp. xii + 219, $9\frac{1}{2} \times 6\frac{1}{4}$. (Haarlem: De Erven F. Bohn N.V.; London: P. S. King & Son, Ltd., 1939.) Price hfl. 2.

FIRST REPORT ON REFRACTORY MATERIALS. The Iron and Steel Institute, Special Report No. 26. Pp. vi + 478, $8\frac{1}{2} \times 5\frac{1}{4}$. (London: The Iron and Steel Institute, 1939.) Price 16*s*.

BIBLIOGRAPHY

Comprising the more important reports, articles, etc., contained in mineral publications received in the Library of the Imperial Institute during the three months February-April 1939.

The publications issued by the Governments of the Colonies and Protectorates can be obtained from or through the Crown Agents for the Colonies, 4 *Millbank, Westminster, S.W.*1. *Applications for Dominion and Indian Government publications may be made to the Offices of the High Commissioners or Agents-General in London.*

OFFICIAL ANNUAL REPORTS

List of Quarries (under the Quarries Act, 1894) in Great Britain and the Isle of Man, 1937. *Mines Dep.* Pp. 403, $9\frac{3}{4} \times 6$. (London: H.M. Stationery Office, 1939.) Price 10*s*.

Transvaal: Reports of the Executive Committee, Gold Producers' Committee and Collieries Committee for the year 1938. Pp. 31, $9\frac{1}{2} \times 7\frac{1}{4}$. (Johannesburg: Transvaal Chamber of Mines, 1939.)

Canada: Report of the Department of Mines and Resources, including Report of Soldier Settlement of Canada for the fiscal year ended March 31, 1938. Pp. 330, $9\frac{1}{2} \times 6\frac{1}{2}$. (Ottawa: King's Printer, 1939.) Price 50 cents.

Preliminary Report on the Mineral Production of Canada during the calendar year 1938. *Min. Metall. Chem. Br., Dom. Bur. Stats.* Pp. 44, $9\frac{3}{4} \times 6\frac{1}{2}$. (Ottawa: King's Printer, 1939.) Price 25 cents.

Nova Scotia: Annual Report on Mines, 1938. *Dep. Pub. Works Mines.* Pp. 270, $9\frac{3}{4} \times 6\frac{1}{2}$. (Halifax, N.S.: Provincial Secretary, King's Printer, 1939.)

Quebec: Preliminary Statement on the Mineral Production in the calendar year 1938. *Quebec Bur. Mines.* Pp. 12, $9\frac{3}{4} \times 6\frac{3}{4}$. (Quebec: King's Printer, 1939.)

Ontario: Forty-sixth Annual Report of the Department of Mines, 1937. Vol. 46, Parts 4, 5, 6, and 7. Pp. 260, 9¾ × 6¾. (Toronto: King's Printer, 1938.)

Preliminary Report on the Mineral Production of Ontario in 1938. Prepared by A. C. Young. *Bull. No.* 122, *Ont. Dep. Mines.* Pp. 29, 10 × 6½. (Toronto: King's Printer, 1939.)

Victoria: Annual Report of the Department of Mines, including Gold and Mineral Statistics and Boring Records for the year 1938. Pp. 40, 13 × 8¼. (Melbourne: Government Printer, 1939.)

Mining in New Zealand. Pp. 15, 10 × 6. (Wellington: Government Printer, 1939.) Extract from the New Zealand Official Year Book, 1939.

Comité d'Études Minières pour la France d'Outre-Mer: Rapport présenté à l'Assemblée Générale du 24 janvier, 1939. Pp. 28, 10½ × 8. (Paris: Comité d'Études Minières, 13 Rue de Bourgogne, 1939.)

Statistique de l'Industrie Minière de la Grèce pendant l'année 1937. By A. Tsaconas. Pp. 67, 9 × 6½. (Athens: Imprimerie Nationale, 1938.)

Annual Report of the Director of the Mint for the fiscal year ended June 30, 1938, including Report on the Production of the Precious Metals during the calendar year 1937. Pp. 112, 9½ × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 50 cents.

Annual Report of the Non-Metals Division for the fiscal year 1938. By O. C. Ralston and others. *Rep. Invest. No.* 3427, *U.S. Bur. Mines.* Pp. 38, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.)

Illinois Mineral Industry in 1937: A Preliminary Statistical Summary and Economic Review. By W. H. Voskuil, A. R. Sweeny, and G. N. Oliver. *Rep. Invest. No.* 51, *Illinois State Geol. Surv.* Pp. 51, 9¾ × 6¾. (Urbana: State Geological Survey Division, 1938.) A report on the non-metallic production of the State.

Brazil: Relatoria da Directoria, 1936. By A. I. de Oliveira. *Bol. No.* 29, *Serv. Fom. Prod. Mineral.* Pp. 257, 9 × 6½. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

MINING LAW

Coal Mines Act, 1911: Regulations and Orders relating to Safety and Health. 1939 Edition (revised to January 20, 1939.) *Mines Dep.* Pp. 199, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 1*s.* 6*d.*

Gold Coast Colony: Mining Regulations Handbook. 1938 Edition. Pp. 87, 9¾ × 6½. (London: Crown Agents for the Colonies, 4 Millbank, S.W.1., 1939.) Price 3*s.*

Gold Coast Colony: Regulations made under the Mining Rights Regulation Ordinance. Regulations No. 7 of 1939. *Gold Coast Gaz.*, March 11, 1939, No. 6, p. 324.

Kenya: A Bill to Amend the Mining Ordinance, 1933. *Offic. Gaz., Kenya*, March 14, 1939, **41**, 275-292.

British Guiana: Regulations to Amend the Mining Regulations, 1931, with respect to the Rent payable for Concessions and Leases and the Royalty payable on Precious Stones. Mining (Amendment) Regulations (No. 2) 1938. Pp. 2, 9½ × 6. (London: Crown Agents for the Colonies, 4 Millbank, S.W.1, 1938.) Price 8*d.*

The Burma Oil Fields Manual, 1938. Corrected up to April 1, 1938. Pp. 91, 9¾ × 6½. (Rangoon: Superintendent, Government Printing and Stationery, 1938.) Price Re. 1, or 1*s.* 6*d.*

India: A Bill to make Further Provision for safety in Coal Mines. L.A. Bill No. 4 of 1939. *Calcutta Gaz.*, March 16, 1939, Pt. 6, pp. 18-23.

Palestine: Oil Mining (Amendment) Rules, 1939. *Palestine Gaz.*, April 6, 1939, No. 877, Suppt. No. 2, pp. 271-273.

Federal Placer-Mining Laws and Regulations. By F. W. Johnson. *Tech. Pap. No.* 591, *Bur. Mines, U.S. Dep. Int.* Pp. 25, 9 × 6 (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

New Petroleum Law of Venezuela. By H. P. Crawford. *Comm. Rep.* (*U.S.*), 1939, No. 3, 52-53.

COMMERCIAL INTELLIGENCE

Mining Year Book, with which is Incorporated the Mining Manual for 1939. Compiled by W. E. Skinner. Pp. 872, 8 × 5. (London: W. E. Skinner, 1939.) Price 20*s*. A record of information concerning mining companies, and a dictionary of mining terms, etc.

Annual Review of the Mineral Industry for 1938. *Min. J., Ann. Rev. No.*, 1939, **204**, 155-268.

Metal Report, 1938. Pp. 36, 10 × 8. (London: Brandeis, Goldschmidt and Co., Ltd., 1939.)

The Engineer: Directory and Buyers Guide, 1939. Pp. 260, 8 × 5. (London: The Engineer, Essex Street, W.C.2, 1939.) A bi-annual directory of firms advertising in The Engineer.

Review of Base Metal Conditions: Non-Ferrous Metals in 1938. Pp. 11, 10 × 8. (London: British Metal Corporation, Ltd., 1939.)

The Iron and Steel Trades in 1938. Special Review. Pp. 40, 9 × 7. (London: William Jacks & Co., Ltd., 1939.)

The Concrete Year Book, 1939. Edited by O. Faber and H. L. Childe. Pp. 1052, 8½ × 5½. (London: Concrete Publications, Ltd., 1939.) Price 4*s*.

Rhodesian Mining Year Book, 1939. Pp. 116 + clxxxiv, 13¾ × 9½. (Johannesburg: S.A. Mining Journal Syndicate Ltd.; London: Argus South African Newspapers, Ltd., 1939.) Price 10*s*. 6*d*., London price 12*s*.

Industrial Minerals: A Quarterly Report showing Production, Local Sales, Exports and Names of Producers of Industrial Minerals for the Union of South Africa and the Territory of South-west Africa. *Quart. Inform. Circ. No.* 16, *October to December*, 1938, *Dep. Mines, Union S. Afr.* Pp. 50, 11 × 8½. (Pretoria: Government Printer, 1939.)

Metal Statistics, 1939. Thirty-second Annual Edition. Pp. 632, 6 × 4. (New York: American Metal Market, 1939.) Price $2.

1938 Supplement to Book of A.S.T.M. Standards. Pp. 241, 9 × 6. (Philadelphia, Pa.: American Society for Testing Materials, 1938.)

Deutsches Bergbau-Jahrbuch: Jahr- und Anschriftenbuch der deutschen Steinkohlen-, Braunkohlen-, Kali- und Erzindustrie, der Salinen, des Erdöl- und Asphaltbergbaus, 1939. Pp. 395, 9 × 6. (Halle [Saale]: Verlag von Wilhelm Knapp, 1939.)

GEOLOGY AND MINERAL RESOURCES

The Birth and Development of the Geological Sciences. By F. D. Adams. Pp. v + 506, 10 × 7. (London: Bailliere, Tindall & Cox, 1938.) Price 22*s*. 6*d*.

Manual of Sedimentary Petrography. By W. C. Krumbein and F. J. Pettijohn. Pp. xiv + 549, 9 × 6. (New York and London: D. Appleton-Century Company, Inc., 1938.) Price 30*s*.

Review of the International Situation during 1938, with Special Reference to Mineral Production and Trade of Central Europe. By C. W. Wright and others. *Foreign Miner. Quart.* (*U.S.*), 1939, **2**, No. 2, 72 pp.

Applied Geology at Halkyn District United Mines, Limited. By G. A. Schnellmann. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 415, 40 pp.

Geological Survey of Kenya: Notes on the Geology of the Country surrounding Nairobi. By H. L. Sikes. *Min. Geol. Dep.* Pp. 30, $9\frac{1}{2} \times 6$, and map. (Nairobi: Government Printer, 1939.) Price 2*s*.

Tanganyika Territory: Explanation of the Geology of Degree Sheet No. 29 (Singida). By N. W. Eades and W. H. Reeve. *Bull. No.* 11, *Geol. Div., Dep. Lds. Mines.* Pp. 59, $10 \times 6\frac{3}{4}$, and maps. (Dar es Salaam: Government Printer, 1938.) Price 4*s*.

A Series of Papers relating to the Geology of Uganda with Bibliography and Provisional Geological Map. *Bull. No.* 3, *Geol. Surv. Uganda.* Pp. 196, 10×8, and map. (Entebbe: Government Printer, 1939.) Price 10*s*. 6*d*. [See also under Metals and Non-Metals for papers on Economic Geology.]

British Guiana: Report on the Geological Survey of the Area between Tinamu Fall and the Kutuau River on the Left Bank of the Cuyuni River. By S. Bracewell. *Bull. Geol. Surv. Brit. Guiana*, 1938, No. 12, 38-49.

Mining in Canada during 1938. By W. H. Losee. *Canad. Min. J.*, 1939, **60**, 63-67.

Preliminary Geologic Report on the Johnson Brook Area Country Harbor Mines, Guysboro County, Nova Scotia. By H. L. Cameron. *Ann. Rep. Mines, Nova Scotia*, 1938, Pt. 2, pp. 29-35 (1939).

The Mineralogy of Nova Scotia. By E. J. Cox and G. V. Douglas. *Ann. Rep. Mines, Nova Scotia*, 1938, Pt. 2, pp. 36-50 (1939).

Thesis on Paragenesis of Minerals in Nova Scotia Gold Quartz Veins. By R. B. Harrison. *Ann. Rep. Mines, Nova Scotia*, 1938, Pt. 2, pp. 5-11 (1939).

Mining in New Brunswick during 1938. *Canad. Min. J.*, 1939, **60**, 92.

Mining in Quebec during 1938. By N. R. Arthur. *Canad. Min. J.*, 1939, **60**, 71-76.

Mining in Ontario during 1938. By H. Browning. *Canad. Min. J.*, 1939, **60**, 68-70.

The Canadian Mineral Industry, the Provinces: (*e*) Ontario. By E. J. Pryor. *Min. Mag., Lond.*, 1939, **60**, 148-156, 210-219.

The Canadian Mineral Industry, the Provinces: (*d*) Manitoba. By E. J. Pryor. *Min. Mag., Lond.*, 1939, **60**, 80-89.

Mining in Manitoba during 1938. By J. P. de Wet. *Canad. Min. J.*, 1939, **60**, 77-82.

The Canadian Mineral Industry, the Provinces: (*c*) Saskatchewan. By E. J. Pryor. *Min. Mag., Lond.*, 1939, **60**, 79-80.

Mining in British Columbia during 1938. By H. G. Nichols. *Canad. Min. J.*, 1939, **60**, 87-92.

Geology of India. By D. N. Wadia. Second Edition. Pp. xx + 460, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: Macmillan & Co., Ltd., 1939.) Price 24*s*.

The Geology of Palanpur, Danta, and part of Idar States. By A. M. Heron and P. K. Ghosh. *Rec. Geol. Surv. India*, 1938, **72**, 367-412.

The Geology of the Neighbourhood of Tapah and Telok Anson, Perak, Federated Malay States, with an Account of the Mineral Deposits. By F. T. Ingham. *Geol. Surv. Dep., F.M.S.* Pp. 72, $10\frac{3}{4} \times 7\frac{1}{4}$, and maps. (Singapore: Printers, Ltd., 1938.) Price $3.

The Structure of Victoria with Respect to the Lower Palæozoic Rocks. By D. E. Thomas. *Min. Geol. J.*, 1939, **1**, No. 4, 59-64.

Aus der Tschecho-slowakischen Metallwirtschaft. *Montan. Rdsch.*, 1939, **31**, No. 5, 152-160.

Die Entwicklung des Doggererzbergbaues in Pegnitz bis zur Einführung des Langfrontrückbaues (Strebbruchbaues). By F. Beckenbauer. *Glückauf*, 1939, **75**, 121-128, 153-158.

Vorbehaltene Mineralien in Grossdeutschland. By H. Schoen. *Montan. Rdsch.*, 1939, **31**, 200-204.

Die Erzlagerstätten des Sudetengaues. By F. Wernicke. *Metall u. Erz*, 1939, **36**, 147-157, 175-185.

Ciò che dà il Sottosuolo di Sicilia. *Industr. Min. Ital. Oltremare*, 1939-XVII, **13**, 15-18.

Das Erzgebiet von Brskova, Montenegro. By F. Hermann. *Metall u. Erz*, 1939, **36**, 123-124.

Mineral Resources of Ukraine. *Iron Coal Tr. Rev.*, 1939, **138**, 411.

Das Erzvorkommen von Mechmana-Güljatag bei Elisabethpol, U.S.S.R. By G. Petunnikov. *Montan. Rdsch.*, 1939, **31**, 89-92; 133-135.

The Urals Excursion and Notes on the XVIIth International Geological Congress, Moscow, July-August, 1937. By E. Spencer. *Trans. Min. Geol. Metall. Inst. India*, 1938, **34**, Pt. 3, 215-231. A description of a geological excursion, including visits to gold, platinum, chromite, magnesite, asbestos, nickel, copper, hematite and magnetite, titaniferous magnetite, scheelite, and coal mines.

Die Lagerstätte der Trepca Mines Limited in Jugoslawien und die Aufbereitung dieser Erze. By H. Sommerlatte. *Metall u. Erz*, 1939, **36**, 95-100.

Promesse Minerarie nel Territorio dei Galla e Sidama. By R. di Lauro. *Industr. Min. Ital. Oltremare*, 1939-XVII, **13**, 19-24.

Ricerche Geologiche nel Territorio del Cer-Cer (A.O.I.). By C. Lebling and E. Nowack. *Industr. Min. Ital. Oltremare*, 1939-XVII, **13**, 51-63. Eseguite dalla Missione Mineraria Italo-Germanica della S.A. Mineraria A.O.I.—Milano.

Sur la Composition et l'Attribution au Jurasso-crétacé de la série schisteuse du Maio Lidi (Cameroun septentrional). By R. van Aubel. Sur les Roches du soubassement de la Région entre Bangui et le Cameroun. By V. Babet. *Publ. No.* 10. Pp. 43, 10 × 6½. (Paris: Bureau d'Études Géologiques et Minières Coloniales, 1939.) Price 15 francs.

Situation de l'Industrie Minière Marocaine. *Écho Min. Metall.*, 1939, **67**, 105.

The Nushagak District, Alaska. By J. B. Mertie, Jun. *Geol. Surv. Bull. No.* 903, *U.S. Dep. Int.* Pp. 96, 9 × 6, and maps. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 65 cents. An account of the general and economic geology of the area.

Geology of the Chitina Valley and Adjacent Area, Alaska. By F. H. Moffit. *Geol. Surv. Bull. No.* 894, *U.S. Dep. Int.* Pp. 137, 9 × 6, and maps. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price $1.25. An account of the general and economic geology of the area.

Geology of the Slana-Tok District, Alaska. By F. H. Moffit. *Geol. Surv. Bull. No.* 904, *U.S. Dep. Int.* Pp. 54, 9 × 6, and map. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 35 cents.

Geology of the Bonanza King Mine, Humboldt Range, Pershing Country, Nevada. By D. F. Campbell. *Econ. Geol.*, 1939, **34**, 96-112. A description of the geology and structure of the area, which

contains a high-grade ore body. The latter is a quartz vein containing various sulphides, some of which carry gold and silver.

Reconnaissance of Mining Districts in Lander County, Nevada. By W. O. Vanderburg. *Inform. Circ. No.* 7043, *U.S. Bur. Mines.* Pp. 83, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Geology of the Marathon Region, Texas. By P. B. King. *Prof. Pap. No.* 187, *Geol. Surv., U.S. Dep. Interior.* Pp. 148, 11½ × 9, and maps. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1937.) Price $2.50. An account of the general and economic geology of the area.

The San Juan Country: a Geographic and Geologic Reconnaissance of South-eastern Utah. By H. E. Gregory and M. R. Thorpe. *Prof. Pap. No.* 188, *U.S. Geol. Surv.* Pp. 123, 11½ × 9¼. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 60 cents.

Esportazione Minerale dal Pèru. *Industr. Min. Ital. Oltremare,* 1939-XVII, **13,** 25-27.

PROSPECTING AND MINING METHODS

(*See also under Metals and Non-Metals.*)

Étude des Altérations superficielles: Application à l'Exploration géologique et minière. *Publ. No.* 12. Pp. vii + 112, 10 × 6½. (Paris: Bureau d'Études Géologiques et Minières Coloniales, 1939.) Price 30 francs.

Metodi Moderni di Collegamento Topografico attraverso Pozzi di Miniera. By G. Aprile and T. Seguiti. *Industr. Min. Ital. Oltremare,* 1939-XVII, **13,** 3-13.

Geophysics as applied to Structural Geology. By I. C. H. Croll. *Min. Geol. J.,* 1939, **1,** No. 4, 51-58.

Ventilating Fans for Mines. By E. L. Dilworth. *Canad. Min. J.,* 1939, **60,** 136-139.

Geophysical Prospecting: its part in American Mining. By V. G. Gabriel. *Engng. Min. J.,* 1939, **140,** No. 4, 50-53.

Metallogenese e a Theoria Migratoria dos Elementos. By D. Guimarães. *Bol. No.* 24, *Serv. Fom. Prod. Mineral.* Pp. 67, 9 × 6½. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Disrupted Strata: Faulting and its Allied Problems from the Standpoint of the Mine Surveyor and Stratigraphist. By M. H. Haddock. Second Edition. Pp. xvi + 104, 9¾ × 6¼. (London: The Technical Press, Ltd., 1938.) Price 16*s*.

Mine Ventilation. By D. Harrington. *Inform. Circ. No.* 7047, *U.S. Bur. Mines.* Pp. 16, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Small-Scale Placer-Mining Methods. By C. F. Jackson. *Tech. Pap. No.* 591, *Bur. Mines, U.S. Dep. Int.* Pp. 22, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 10 cents.

Some Principles and Practices of Profitable Gold Mine Operation. By I. M. Marshall. *Canad. Min. Metall. Bull.,* 1939, No. 322, 81-94.

Geophysical Exploration by Spontaneous Polarisation Methods. By E. Poldini. *Min. Mag., Lond.,* 1939, **60,** 90-94.

The Construction and Maintenance of Iron Flumes in Hydraulic Mining. By K. B. Swamy. *Trans. Min. Geol. Metall. Inst. India,* 1938, **34,** Pt. 3, 233-243.

Temperature Measurements with an Electrical Resistance Thermometer in a Deep Borehole on the East Rand. By O. Weiss. *J. Chem. Soc. S. Afr.,* 1938, **39,** 149-166.

CONCENTRATION AND METALLURGY

(*See also under Metals and Non-Metals.*)

Progress Reports—Metallurgical Division: Ore-Testing Studies, 1937-1938. By the Staff of the Metallurgical Division. *Rep. Invest. No.* 3425, *U.S. Bur. Mines.* Pp. 119, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Special methods of analysis and testing and details of tests on various ores.

Metals. By Sir H. Carpenter and J. M. Robertson. Volume I. Pp. xxii + 823. Volume II. Pp. xii + 825-1485, 9¾ × 6¼. (London, New York, Toronto: Oxford University Press, 1939.) Price 105*s*., the two volumes.

Assay for Metals of the Platinum Group. By C. C. Downie. *Min. Mag., Lond.*, 1939, **60**, 73-76. A description of the procedure usually applied to the determination of the platinum-group metals present in concentrates, residues, speiss, etc.

Dust Control at the Hollinger Milling Plant. By P. J. Dunlop. *Canad. Min. Metall. Bull.*, 1939, No. 323, 164-184.

Amalgamation of Auriferous Concentrates. By A. E. Flynn. *Canad. Min. Metall. Bull.*, 1939, No. 323, 150-163.

Neue Wege zur Leichtmetallgewinnung. By H. Grothe. *Metall u. Erz*, 1939, **39**, 63-72.

Use of Control and Measuring Instruments in Ore Treatment. By A. V. Hemmens. *Chem. Engng. Min. Rev.*, 1939, **31**, 201-205.

Some Difficulties encountered in Gold Recovery. By R. W. Irwin. *J. Chem. Soc. S. Afr.*, 1939, **39**, 178-184.

Primary Crushing: Summary of Field Tests. By M. Sheppard. *Rep. Invest. No.* 3432, *U.S. Bur. Mines.* Pp. 41, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Crushing in the non-metallic industries.

Engineering Metallurgy. By B. Stoughton and A. Butts. Third Edition. Pp. ix + 525, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1938.) Price 24*s*.

Some Studies with the Haultain Superpanner and Infrasizer. By H. V. Warren, C. Madsen, and W. H. White. *Canad. Min. Metall. Bull.*, 1939, No. 322, 53-56.

Treatment of Arsenical Gold Ores. By J. A. Woolf and T. A. Jackson. *Canad. Min. J.*, 1939, **60**, 127, 131.

METALS

Aluminium and Bauxite

Alunite—A New Source of Aluminium. *Light Metals*, 1939, **2**, 115. A description of a process which may be used for the profitable exploitation of the alunite deposits in Piute County, Utah, U.S.A.

Die Anodenkohle bei der Aluminiumerzeugung. By H. Ginsberg. *Metall u. Erz*, 1939, **36**, 72-76.

Primary Aluminium: a Discussion of the Trends of International Trade in this important Metal. By R. J. Anderson. *Min. Mag., Lond.*, 1939, **60**, 206-209.

World Position of Magnesium and Aluminium. By J. Rubinfield. *Chem. Engng. Min. Rev.*, 1939, **31**, 168-169.

The Canadian Aluminium Industry. *Metallurgia, Manchr.*, 1939, **19**, 205-207.

A Study of the Industrial Possibilities of Indian Bauxite. By U. Chatterjee, B. C. Roy, and H. N. Das-Gupta. *J. Indian Chem. Soc.* (*Industr. News Ed.*), 1938, **1**, 127-136.

Neue Wege zur Leichtmetallgewinnung. By H. Grothe. *Metall u. Erz*, 1939, **36**, 63-72.

Trends of Development in the Aluminium Industry of Germany. By H. Röhrig. *Metallurgia, Manchr.*, 1939, **19**, 126-129.

Rumanian Bauxite Deposits. *Min. J.*, 1939, **204**, 110.

Development and Research in the Russian Aluminium Industry. By A. Behr. *Metallurgia, Manchr.*, 1939, **19**, 137-138.

Chromium

Chrome Ores as used in the Refractories Industry. By T. R. Lynam and W. J. Rees. *Trans. Brit. Ceram. Soc.*, 1939, **38**, 211-225.

Cobalt

The Nickel-Cobalt—Native Silver Ore Type. By E. S. Bastin. *Econ. Geol.*, 1939, **34**, 1-40. A survey of the salient features of the principal deposits, with discussion as to their origin and enrichment.

Copper

Brazil: Cobre no Estado da Baia. By O. H. Leonardos. *Avulso No.* 31, *Serv. Fom. Prod. Mineral.* Pp. 13, 9 × 6½. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Cobre, Estanho e Outros Minerais em Picuí e soledade, Paraíba do Norte. By L. J. de Moraes. *Bol. No.* 28, *Serv. Fom. Prod. Mineral.* Pp. 26, 9 × 6½. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Gold

Mwanza Goldfield Geology, Tanganyika Territory. By R. O. Roberts. *Min. Mag., Lond.*, 1939, **60**, 137-147. Notes on the geology of the Geita, Ridge 8, and Mawe Meru gold mines.

Preliminary Investigations on the Gold Lodes of the Busia Area, Samia County, Eastern Province. By K. A. Davies. *Bull. Geol. Surv. Uganda*, 1939, No. 3, 103-112.

Coated Gold from the Lubare Area, Ankole. By K. A. Davies. *Bull. Geol. Surv. Uganda*, 1939, No. 3, 113.

Notes on the Gold, Pyrite, and Carbon in the Rand Banket. By M. S. Fisher. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 414, 36 pp.

British Guiana: Explanatory Note on the Geological Map of the Groete Creek—Lower Cuyuni—Puruni Goldfield. By S. Bracewell. *Bull. Geol. Surv. Brit. Guiana*, 1938, No. 12, 1-8.

Report on the Geology and Gold Deposits of the Kartabu-Oko-Aremu Section of the Cuyuni District, 1935. By D. R. Grantham. *Bull. Geol. Surv. Brit. Guiana*, 1938, No. 12, 9-19.

Report on the Geology and Gold Deposits of the Wariri-Aremu-Quartzstone Section of the Cuyuni District. By D. R. Grantham. *Bull. Geol. Surv. Brit. Guiana*, 1938, No. 12, 20-37.

Gold Mining in Canada. Pp. 33, 9 × 5¾. (Montreal: Nesbitt, Thomson & Co., Ltd., 1938.) A brief outline of the present position of the Canadian gold mining industry.

The Operation of the Lacey Gold Mine, Chester Basin, Nova Scotia. By A. R. Lawrence and D. W. M. Ross. *Ann. Rep. Mines, Nova Scotia*, 1938, Pt. 2, 51-67 (1939).

Stoping at Noranda. By O. Hall, R. V. Porritt, and A. D. Carmichael. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 414, 16 pp. A description of stoping methods at Noranda gold mines, Quebec.

Mining Methods at Canadian Malartic Gold Mines, Ltd., Quebec. By E. V. Neelands and J. P. Millenbach. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 413, 17 pp.

Spiral Stoping as Applied at the Beattie Mine. By J. Tuttle. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 413, 27 pp. A description of the spiral stoping method of mining, a method used at the Beattie Gold Mines, Quebec, since the beginning of operations.

Gold Production in Ontario: An Analysis of the Industry, its Economic Significance, and the Criteria for its Maintenance. *Canad. Chem. Proc. Industr.*, 1939, **23**, 109-110, 112.

Central Nell Gwynne Mine, Bendigo, Victoria. By J. J. Caldwell. *Min. Geol. J.*, 1939, **1**, No. 4, 23-26.

Gold Dredging in Victoria. By D. R. Dickinson. *Min. Geol. J.*, 1939, **1**, No. 4, 13-20.

Bartle Frere. By C. C. Morton. *Queensland Govt. Min. J.*, 1939, **40**, 3-13. Geologist's report on the Bartle Frere goldfield, and its prospects.

Grasstree Mine and Goldfield, Sarina. By J. H. Reid. *Queensland Govt. Min. J.*, 1939, **40**, 42-48.

Ore Geology of the Day Dawn Mine, New Guinea. By N. H. Fisher. *Econ. Geol.*, 1939, **34**, 173-189.

Gold und Goldbergbau in Schlesien. By H. Mohr. *Montan. Rdsch.*, 1939, **31**, 233-238.

Gold Placers of the Fortymile, Eagle, and Circle Districts, Alaska. By J. B. Mertie, Jun. *Bull. No.* 897-C, *Geol. Surv., U.S. Dep. Int.* Pp. 133-261, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 20 cents.

Gold Mining and Milling in Idaho County, Idaho. By S. H. Lorain. *Inform. Circ. No.* 7039, *U.S. Bur. Mines.* Pp. 90, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) A description of lode gold mining in Idaho County, including information on mining and milling practices, costs, transport, climate, power, and labour.

Ruby Gulch Gold Mining District, Little Rocky Mountains, Montana. By J. L. Dyson. *Econ Geol.*, 1939, **34**, 201-213.

Iron and Steel

Reconstruction of the Irthlingborough Iron Ore Mines, Northants. *Iron Coal Tr. Rev.*, 1939, **138**, 655-656.

Hematite Resources of Cornwall. *Iron Coal Tr. Rev.*, 1939, **138**, 275.

The Iron Ores of the Bailadila Range, Bastar State. By H. Crookshank. *Trans. Min. Geol. Metall. Inst. India*, 1938, **34**, Pt. 3, 253-281.

Small-scale Manufacture of Iron and Steel in India by the Direct Method. By P. N. Mathur. *Trans. Min. Geol. Metall. Inst. India*, 1938, **34**, Pt. 3, 283-304.

Some Problems of the German Iron and Steel Industry. *Iron Coal Tr. Rev.*, 1939, **138**, 410-411. This article discusses experiments made to smelt lean ores efficiently, and refers to the use of a basic slag in the blast furnace.

Das Magneteisensteinlager " El Teuler " bei Cala (Provinz Huelva). By H. Quiring. *Z. prakt. Geol.*, 1939, **47**, 33-38, 53-55.

Metasomatic Origin of the Adirondack Magnetite Deposits, New York. By H. L. Alling. *Econ. Geol.*, 1939, **34**, 141-172.

Brazil: Depósito de Minério de Ferro do Pico de Itabirito, Minas Gerais. By O. H. Leonardos. *Avulso No.* 28, *Serv. Fom. Prod.*

Mineral. Pp. 14, 9 × 6½. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Ferro no Paraná. By O. H. Leonardos. *Bol. No*. 25, *Serv. Fom. Prod. Mineral*. Pp. 65, 9 × 6½. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Lead and Zinc

Direct Production of Metallic Zinc by the Electrothermic Process. By G. F. Weaton and C. C. Long. *Min. J*., 1939, **205**, 364-366. Abstract of a paper read before the A.I.M.E.

Über das Sintern und Rösten von Bleierzen. By H. Wendeborn. *Metall u. Erz*, 1939, **36**, 185-193.

The Lead-Zinc Ore Deposits and Geology of the Arbus Area in Sardinia, Italy. By C. W. Wright. *Econ. Geol*., 1939, **34**, 82-95.

Die Blei- und Zinkerzlagerstätten Jugoslawiens. By F. Hermann and G. Mempel. *Z. prakt. Geol*., 1939, **47**, 21-32.

Das Gutachten Ferdinand von Richthofens über den Comstockgang und seine Bedeutung für die Gegenwart. By B. Knochenhauer. *Z. prakt. Geol*., 1939, **47**, 42.

Lithium

Lithium. By F. L. Hess. *Inform. Circ. No*. 7054, *U.S. Bur. Mines*. Pp. 14, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Magnesium and Magnesium Compounds

World Position of Magnesium and Aluminium. By J. Rubinfield. *Chem. Engng. Min. Rev*., 1939, **31**, 168-169.

Report of the Indian Tariff Board regarding the Grant of Protection to the Magnesium Chloride Industry (including the evidence recorded during the Enquiry). Pp. 121, 9½ × 6½. (Delhi: Manager of Publications, 1938.) Price Rs. 1.6, or 2*s*.

Manganese

The Petrography and Petrology of the Lower Cambrian Manganese Ore of West Merionethshire. By A. W. Woodland. *Quart. J. Geol. Soc., Lond*., 1939, **95**, 1-32.

Brazil: Distrito Manganesifero de Lafayette, Minas Gerais. By E. A. Teixeira. *Avulso No*. 29, *Serv. Fom. Prod. Mineral*. Pp. 21, 9 × 6½. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Mercury

Quicksilver Metallurgy To-day. By A. L. Ransome. *Engng. Min. J*., 1939, **140**, No. 4, 46-49.

Nickel

The Nickel-Cobalt-Native Silver Ore Type. By E. S. Bastin. *Econ. Geol*., 1939, **34**, 1-40. A survey of the salient features of the principal deposits, with discussion as to their origin and enrichment.

The Occurrence of Titanium and Nickel in the Ash from Special Coals. By J. H. Jones and J. M. Miller. *Chem. and Ind*., 1939, **58**, 237-247.

Selenium

Selenium and Tellurium Production Increasing slowly. *Chem. Engng. Min. Rev.*, 1939, **31**, 166-167. The methods employed for production in Australia.

Silver

The Nickel-Cobalt-Native Silver Ore Type. By E. S. Bastin. *Econ. Geol.*, 1939, **34**, 1-40. A survey of the salient features of the principal deposits, with discussion as to their origin and enrichment.

Recovery of Silver from Manganiferous Ore. *Chem. Engng. Min. Rev.*, 1939, **31**, 159-162. Report of experiments to improve recovery of silver from gold-silver-manganese ores of New Guinea.

Tantalum and Columbium

Niobium. By L. Sanderson. *Canad. Min. J.*, 1939, **60**, 132-133. An account of the occurrence, the physical and chemical properties, and uses of niobium.

The Tantalite-Columbite Deposits in South-western Uganda. By A. D. Combe. *Bull. Geol. Surv. Uganda*, 1939, No. 3, 93-102.

Tellurium

Selenium and Tellurium Production Increasing Slowly. *Chem. Engng. Min. Rev.*, 1939, **31**, 166-167. The methods employed for production in Australia.

Tin

The Geology of some of the Tin Deposits of South-west Ankole. By A. D. Combe. *Bull. Geol. Surv. Uganda*, 1939, No. 3, 59-92.

Brazil: Cobre, Estanho e Outros Minerais em Picuí e Soledade, Paraíba do Norte. By L. J. de Moraes. *Bol. No.* 28, *Serv. Fom. Prod. Mineral.* Pp. 26, 9 × 6½. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Titanium

The Occurrence of Titanium and Nickel in the Ash from Special Coals. By J. H. Jones and J. M. Miller. *Chem. and Ind.*, 1939, **58**, 237-247.

Zircon and Rutile from Beach Black Sand Deposits. By W. R. Poole. *Chem. Engng. Min. Rev.*, 1939, **31**, 216-220.

Tungsten

Tungsten in Tasmania. *Chem. Engng. Min. Rev.*, 1939, **31**, 206-207.

NON-METALS

Barytes

Origin of the Sweetwater, Tennessee, Barite Deposits. By R. A. Laurence. *Econ Geol.*, 1939, **34**, 190-200.

Building Materials

The Stone Industries. By O. Bowles. Second Edition. Pp. xiii + 519, 9 × 6. (London: McGraw-Hill Publishing Company, Ltd., 1939.) Price 30*s*.

The Penrhyn Slate Quarry, North Wales. *Min. J.*, 1939, **204**, 98-99. A description of the quarry and method of working.

Der Onyxmarmor von Laas und andere Onyxmarmorarten. By H. Seipp. *Z. prakt. Geol.*, 1939, **47**, 14-16.

Materiali Lapidei della Sardegna. By G. Peverelli. *Industr. Min. Ital. Oltremare*, 1939-XVII, **13**, 47-49.

Clay and China Clay

Improving the Properties of Clays and Shales. By J. G. Phillips. *Bur. Mines Publ. No.* 793, *Mines Geol. Br., Dep. Mines Res., Canada.* Pp. 39, 9¾ × 6½. (Ottawa: King's Printer, 1938.) Price 25 cents.

Bijdrage tot de Studie van het Kaolien en van enkele Belgische Kleisoorten. By W. de Keyser. *Ann. Min., Belg.*, 1938, **39**, 985-1081.

Petrology of the Pennsylvanian Underclays of Illinois. By R. E. Grim and V. T. Allen. *Rep. Invest. No.* 52, *Illinois State Geol. Surv.* Pp. 1485-1514, 9¾ × 6½. (Urbana: State Geological Survey Division, 1938.) Reprinted from *Bull. Geol. Soc. America*, 1938, **49**, 1485-1514.

Coal, etc.

Newfoundland: St. George's Coalfield. By A. M. Bryan. *Inform. Circ. No.* 5, *Geol. Surv. Newfoundland.* Pp. 23, 9 × 6. (St. John's: Geological Survey, 1938.)

Indian Coal Statistics, 1937. *Dep. Comm. Int. Stats., India* Pp. 92, 9½ × 6¼. (Delhi: Manager of Publications, 1939.). Re. 1.4, or 2*s*.

Sudetendeutsche Braunkohle — eine Lebensfrage für die Tschecho-Slowakei. *Montan. Rdsch.*, 1939, **31**, No. 5, 137-138.

Das Raumgewicht der Braunkohlen. By E. Wölk. *Z. prakt. Geol.*, 1939, **47**, 1-11.

L'Industrie houillère dans les Pays-Bas pendant l'année 1937. By L. A. Smeets. *Ann. Min., Belg.*, 1938, **39**, 1083-1102.

Carbonising Properties of West Virginia Coals and Blends of Coals from the Alma, Cedar Grove, Dorothy Powellton A, Eagle, Pocahontas, and Beckley Beds. By A. C. Fieldner, J. D. Davis, W. A. Selvig, R. Thiessen, D. A. Reynolds, C. R. Holmes, and G. C. Sprunk. *Bull. No.* 411, *Bur. Mines, U.S. Dep. Int.* Pp. 162, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 30 cents.

Brazil: Turfa de Rezende, Estado do Rio. By E. A. Teixeira. *Avulso No.* 33, *Serv. Fom. Prod. Mineral.* Pp. 24, 9 × 6¼. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Gypsum

Gypsum and Anhydrite. By F. T. Moyer. *Inform. Circ. No.* 7049, *U.S. Bur. Mines.* Pp. 45, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Lime

The Lime Industry in Canada, 1937. *Min. Metall. Chem. Br., Dom. Bur. Stats.* Pp. 10, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1939.) Price 10 cents.

Mica

Estudo do Agalmatolito. By L. J. de Moraes, V. Leinz, and E. Orosco. *Avulso No.* 32, *Serv. Fom. Prod. Mineral.* Pp. 33, 9 × 6¼. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Mineral Waters

The Water Supply of the County of London from Underground Sources. By S. Buchan. *Mem. Geol. Surv. Great Britain, Dep. Sci. Industr. Res.* Pp. 260, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 6*s*.

Surface Water Supply of the United States, 1936. Part 5. Hudson Bay and Upper Mississippi River Basins. By N. C. Grover and others. *Wat.-Supp. Pap. No.* 805, *U.S. Geol. Surv.* Pp. 288, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 45 cents.

Surface Water Supply of the United States, 1936. Part 2. South Atlantic Slope and Eastern Gulf of Mexico Basins. By N. C. Grover and others. *Wat.-Supp. Pap. No.* 802, *U.S. Geol. Surv.* Pp. 228, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 30 cents.

Surface Water Supply of Hawaii, July 1, 1935, to June 30, 1936. By N. C. Grover and M. H. Carson. *Wat.-Supp. Pap. No.* 815, *U.S. Geol. Surv.* Pp. 108, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 25 cents.

Petroleum, etc.

Studies of Certain Properties of Oil Shale and Shale Oil. Compiled by B. Guthrie. *Bull. No.* 415, *Bur. Mines, U.S. Dep. Int.* Pp. 159, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 25 cents.

Typical Oil-Field Brine-Conditioning Systems: Preparing Brine for Subsurface Injection. By S. S. Taylor, C. J. Wilhelm, and W. C. Holliman. *Rep. Invest. No.* 3434, *U.S. Bur. Mines.* Pp. 71, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

The Oil Situation in Alberta. By G. S. Hume. *Canad. Min. Metall. Bull.*, 1939, No. 322, 68-80.

Alberta's Oil Progress during 1938. By J. L. Irwin. *Canad. Min. J.*, 1939, **60**, 83-86.

Progress in the Petroleum Producing Countries in Europe during 1938. By C. W. Wright. *Internat. Petrol. Tr.*, 1939, **8**, No. 1, 10-17.

A Visit to Russian Oil Districts. By H. G. Kugler. *J. Inst. Petrol.*, 1939, **25**, 68-88. A report on oil districts west of the Urals, the Caucasian oil districts and the Daghestan region.

Brazil: Os Xistos Pirobetuminosos como Reserva Nacional. By S. F. Abbreu. *Avulso No.* 31, *Serv. Fom. Prod. Mineral.* Pp. 18, 9 × 6¼. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Phosphates

Jazidas de Apatita de Ipanema, Estado de São Paulo. By L. J. de Moraes. *Bol. No.* 27, *Serv. Fom. Prod. Mineral.* Pp. 50, 9 × 6½. (Rio de Janeiro: Avenida Pasteur, 404 Praia Vermelha, 1938.)

Potash

Urlaugen und Tageswässer im deutschen Kalibergbau. By E. Fulda. *Z. prakt. Geol.*, 1939, **47**, 11-14.

Quartz

Notes on Rock Crystal and a Reference to some other Forms of Quartz. By E. J. Wayland. *Bull. Geol. Surv. Uganda*, 1939, No. 3, 41-58.

Refractories

Chrome Ores as used in the Refractories Industry. By T. R. Lynam and W. J. Rees. *Trans. Brit. Ceram. Soc.*, 1939, **38,** 211-225.

Fireclays and Alumina Refractories of the Witwatersrand Area and its Environs. By V. L. Bosazza. *Trans. Brit. Ceram. Soc.*, 1939, **38,** 123-130.

Rock Wool

Mineral Wool—the Mining Industry's Fastest Growing Product. By J. R. Thoenen. *Min. and Metall.*, 1939, **20,** 101-105.

Salt

Report on the Administration of Salt Revenue in Burma during the year 1937-1938. Pp. 35, $9\frac{3}{4} \times 6\frac{1}{2}$. (Rangoon: Superintendent, Government Printing and Stationery, 1939.) Price Rs. 2, or 3*s*.

Le Saline Marittime della Sardegna. By G. Conti-Vecchi. *Industr. Min. Ital. Oltremare*, 1939-XVII, **13,** 64-66.

Sulphur

Recovery of Sulphur from Smelter Gases. *Min. J.*, 1939, **205,** 385-386, 409-410.

Thylox Process for the Recovery of Sulphur from Gases containing Hydrogen Sulphide. By G. E. Foxwell and A. Grounds. *Chem. Age*, 1939, **40,** 157-159.

Zircon

Zircon and Rutile from Beach Black Sand Deposits. By W. R. Poole. *Chem. Engng. Min. Rev.*, 1939, **31,** 216-220.

EXHIBITION GALLERIES, FILM LIBRARIES AND CINEMA

NOTES

Exhibition Galleries.—The most notable of the recent additions to the exhibits is an illuminated map of the world specially made for the Colonial Empire Marketing Board and deposited with the Institute on permanent loan for display in the Galleries. This has been installed in a prominent position in the South Gallery opposite the Central Enquiry Stand, where it attracts considerable attention from visitors both old and young.

The map is about 10 ft. square, on glass, and is supported horizontally about 3 ft. from the ground by a plinth composed of panels of Empire woods, each panel bearing a label giving its name and country of origin.

A series of buttons is arranged as a keyboard at the foot of the map and by pressing the central red button the whole Colonial Empire is shown illuminated on the map, the names in white and the countries in red. On releasing the central red button and pressing one in the series of white buttons, one of which is devoted to each colony, the name of the colony concerned is illuminated on the map and, at the same time, in columns on each side are illuminated the names of the more important products exported by that colony.

The secret of the attraction of this map is that the visitor has to do something to "make it work" and he thereby at the same time obtains both amusement and instruction.

In the Indian Court a collection of types of cigarette tobacco grown in the Guntur district of Madras has been received by courtesy of the High Commissioner for India, also photographs illustrating the cultivation and preparation of tobacco for export. These have been arranged in a showcase in association with the Indian tobacco diorama described in this BULLETIN, 1938, **36**, 61; also for this purpose an exhibit illustrating types of Indian cigars and cheroots has been kindly donated by Messrs. A. R. Spencer & Co., Ltd.

A number of locally-made Indian models showing methods of irrigation practised by peasant cultivators in India have been utilised by Mr. H. Cawood in constructing a new composite model. The descriptive label for this reads as follows :

Village Irrigation in India

" This composite scene illustrates various methods of raising water for the irrigation of the fields and crops in Indian villages.

" Five different methods are represented :

" (1) On the right bank of the river, which runs diagonally across the model, can be seen a ' Persian ' wheel worked by oxen which are drawing water from a deep well by means of an endless chain of pots. The water is tipped out in a continuous stream by the revolving wheel into a channel from which it is discharged on to the fields.

" (2) On the same side of the river is a *picottah* or *lat* worked by hand. By this method the water is raised from the river in a bucket or pot hung from a horizontal pole which is made to oscillate up and down on a pivot.

" (3) On the left bank can be seen the *mote*. Here water is being raised from a deep well in a leathern bucket by oxen which move up and down hill on a ramp.

" (4) Close by are two men lifting water from the river by swinging a bucket-scoop. The water is thrown into a trench and driven from there by another man on to the fields.

" (5) Also on the left bank can be seen the *doon*, consisting of a scoop in the form of a hollowed-out tree trunk suspended over the river and attached to a pivot above. The scoop is lowered at one end to receive the water and then, with the aid of the pivot, is tipped and emptied on to the land."

Further progress has been made with the arrangement of the Burma Court, additional accommodation having been provided for the Burma exhibits received at the close of the Empire Exhibition, Scotland, 1938. A run of polished panelling and a framed door and doorway of yinma (*Chickrassia tabularis*) has been fixed to the wall of a bay on the east side of the Court where a good natural light discloses the full beauty of the fine figure possessed by this timber. On opening this door is disclosed some panelling of Burma padauk (*Pterocarpus macrocarpus*), whilst on a bay on the opposite side of the court

has been fixed a run of panelling of laurel-wood (*Terminalia tomentosa*).

Five coloured transparencies have been made for the Travancore Court and these occupy the spaces above the diorama of the Port of Alleppey (which is now nearing completion). The subjects of these transparencies are: The Commercial Canal, Alleppey; Cape Cormorin—India's Land's End; Spinning Coir Yarn; Finishing Coir Mats; Sri Padmanabha Swami Temple.

For the Seychelles Court the following items have been received through the Director of Agriculture as replacements of, or additions to, the exhibits displayed in showcases: Tortoise shell work (bangles, trays, buckles and buttons, salad servers and cigarette cases and holders); crochet and lacework; essential oils (cinnamon leaf and bark oil, patchouli, peppermint, eucalyptus, citronella, lemon grass and palmarosa); vanilla; cinnamon quills and powder; coco-de-mer nuts polished and unpolished; and turtle oil and callipee.

In the Somaliland Court a new story exhibit has been arranged in a centre table case to illustrate the utilisation of Somaliland sheep skins in the making of suede gloves. Starting with the raw skin the exhibits include dehaired, tanned, and dyed skins of various colours followed by a cut skin, then the cut parts assembled, and finally examples of finished gloves. This exhibit was shown on His Majesty's East African Dependencies' stand at the British Industries Fair by Messrs. Fownes Gloves, Ltd., and was generously donated to the Institute by this firm at the close of the Fair for use in the Somaliland Court.

To the East African Court have been added examples of rugs and matting made from dyed sisal fibre. These were kindly supplied by Mr. G. C. Anderson by courtesy of Messrs. H. C. Browning & Co., Ltd.

To augment the series previously supplied some excellent photographs of tea manufacture in Kenya have been received from the Secretary of the Kenya Tea Growers Association, whilst the Director of the Geological Survey, Uganda, has forwarded a sample of laterite to illustrate the importance and ubiquity of this formation over the greater part of the Uganda Protectorate.

Photographs for use in arranging a travelogue of Uganda have been received from the Game Warden and Chairman of the Uganda Publicity Committee.

The display of wax models of South African fruit, described in this BULLETIN, 1938, **36**, p. 504, has been considerably enhanced by the addition of a number of bowls and dishes of matt green glaze generously loaned by the manufacturers, Messrs. Josiah Wedgwood & Sons, Ltd. The matt green of

PLATE VI

THE KAIETEUR FALLS, BRITISH GUIANA.

Reproduced from a Diorama in the Exhibition Galleries of the Imperial Institute.

these receptacles gives just the right note of colour in the scheme and serves to link up the three cases which have been devoted to the display of these attractive models.

In the West African Court progress has been made with the arrangement of the new exhibits acquired at the close of the Empire Exhibition, Scotland, 1938. On the east wall of the Court, above the range of panels of Gold Coast timbers described in this BULLETIN, 1939, **37**, 162, have been fixed the large coloured transparencies showing panoramic views of West African ports, namely, Takoradi, Freetown, Bathurst and Lagos. These, together with silk banners bearing the official badges of the colonies, and the brightly coloured silk pagns of local weave, give an appropriate and colourful setting for the more prosaic exhibits.

For the Malta Court a large panoramic oil painting of the Grand Harbour has been received from the Malta Government through their London Office and has been fixed to the balustrade on the staircase leading from the North Gallery, where the Malta Court is situated, to the West Gallery occupied by Canada. In this position the painting dominates the Malta Court and supplies a welcome note of colour as well as an attractive scene.

In the Falkland Islands Court an exhibit has been arranged in co-operation with Messrs. Paton & Baldwins, Ltd., who have kindly donated the photographs of machines producing knitting wools in mills at Alloa and samples of wool which were exhibited by them at the Glasgow Exhibition. Wool from the Falklands has " a soft kindly feel," and is used almost entirely for knitting purposes. Scotland, moreover, appears to take full control of the clip from the Falkland Islands, first, through the London company that takes charge of the trade of the colony; secondly, of the manufacture into knitting wool; and, finally, of the marketing of the finished product. The exhibit is in story form and describes the transformation from the raw material to the ready-for-use stage.

From funds specially granted for the purpose by the Government of British Guiana, a diorama of the famous Kaieteur Falls has been constructed in the Imperial Institute studio by Mr. Montague Black. This diorama, one of the most striking in our collections, is now installed in the British Guiana Court (see Plate VI). The descriptive label attached to it reads as follows:

British Guiana

Kaieteur Falls

" One of the physical features of the western portion of British Guiana is the series of plateaux rising like a gigantic

staircase to the Venezuelan border, and down it the rivers flowing from this region have to plunge on their way to the sea. As a result there are several remarkable falls in the Colony, but the best known is Kaieteur, the subject of this diorama.

" Kaieteur was discovered by Mr. Barrington Brown of the Geological Survey in 1870. The falls have a sheer drop of 741 ft., i.e. about three times the height of the central tower of the Imperial Institute.

" This view of Kaieteur Falls is from a point on the Potaro River about a mile below the falls, and provides one of the most impressive spectacles in the world.

" A motor road has been built to a point near the foot of the cataract rendering approach easy. The journey can also be made by boat, during which the skill of the boatmen in passing up the various rapids on the Potaro is fully demonstrated. From below, the approach passes through a magnificent gorge with virgin tropical forests lining both banks of the river."

A sample of Tasmanian leatherwood flower honey and a number of tins representing the various preserved Tasmanian fruit pulps exported to the United Kingdom have been received from the Agent-General for Tasmania for exhibition in the Australian Court.

In the windows of the Sarawak Court have been installed five carbon transparencies, the subjects being Kuching, the capital; a native fish trap; a prahu laden with mangrove bark; and a native-made lift for raising water used in sago manufacture. A Dyak blanket and two Dyak women's skirts, woven in traditional designs, have been received from the Sarawak Government Agent and are exhibited in the Court.

A new diorama illustrating the sago industry in Sarawak has been designed and constructed in the Imperial Institute studio by Mr. E. Whatley. This pairs with one illustrating the pepper industry referred to in this BULLETIN, p. 165. The descriptive label attached to the diorama reads as follows:

A Sago Scene in Sarawak

" This scene illustrates the production and preparation of sago, one of the principal export products of Sarawak. On the left can be seen mature sago palms[1] about ten years old which are being felled. The trunks are being cut up into short

[1] *Metroxylon sagu.*

lengths and rolled away to the shed in the distance. Here the bark is stripped off and the mass of starchy pith that fills the stem is rasped down to a powder which is separated from fibrous matter by straining through a palm-leaf mat. The raw sago thus obtained is transferred by boat to the factory further to the right to be refined. In the factory the sago flour is filtered with water through several cloths and run into inclined troughs in which the fine flour settles to the bottom, the light impurities being carried away on the surface.

"To the right of the factory buildings can be seen a water-lift raising water for use in the refining process. In the foreground and centre of the scene the refined sago spread on palm-leaf mats is being exposed on a raised floor to dry in the sun. Beyond the drying floor can be seen the bagged sago flour awaiting shipment overseas."

Two new series of picture postcards have been added to the Imperial Institute series of cards illustrating some of the more important products and industries of countries in the Empire overseas. These additions relate to pepper production and the making of sago flour in Sarawak. Each series comprises six photographic cards showing successive stages in the preparation of the finished product and is accompanied by a descriptive leaflet and map.

The cards are sold at 6d. per packet and are issued primarily for use in schools with the epidiascope.

Exhibition of Uganda Paintings and Handicrafts.—At the request of the Governor of Uganda the Exhibition Pavilion was placed at the disposal of Mrs. Trowell who arranged, on behalf of the Uganda Government, an exhibition of paintings by Africans, and examples of local handicrafts.

The exhibition was opened by Lord Hailey on April 26 and closed on May 13.

The following notice of the Exhibition was issued by the organisers:

"In Uganda there has been no tradition of pictorial art to build upon, and the work shown at the Imperial Institute is the result of an experiment which has lasted only some three years. The work can be divided into three classes.

"In the first group is included the work of a number of men whose general education was of a very lowly level, and whose contact with English pictures was negligible, and would continue to be negligible. These men were shown nothing at all to guide them in their picture making, and the one rule

they were given was to fill up the whole of their paper. They attacked their work with the self-confidence and vigour of an unspoilt child; obviously their intention was to portray life as they saw it; what they achieved in colour and design was unconscious. They were in a number of instances given biblical subjects because they could read them in their own vernacular, and these they quite naturally portrayed as scenes from native life. The naivety of dressing the 'Wise men' in shorts, jerseys and fezes, or alternatively trilby hats 'because they were rich,' gives the key to the unspoilt freshness of the artist's mind; yet it is because of their single-mindedness and lack of pose they have achieved pictures of real æsthetic worth.

"The third group, who like the first, worked with Mrs. Trowell, are of a very different type. Here we have students picked for their intelligence from the territories working, in English, at about the level of English matric., at Makerere College. These, as may be imagined, were far more difficult to get going. In the first place they were self-conscious and fearful of derision at their efforts; in the second their aim in life was to achieve European standards, and their ideas of European art were based on poorly illustrated textbooks, advertisements, picture papers and third-rate pictures glimpsed in European houses. In order to combat this, short talks on History of Art were given them, they were shown any reproductions of good pictures of every age and race that could be found, and they were encouraged to develop a critical attitude towards all that they saw. They were taught to feel that the African had already made a great contribution to art in negro sculpture, and that he would have still more to give when he had learnt to paint. All this in discussion before and after; in their actual work the one thing that was encouraged was that they should experiment; we were out to break a tendency to follow the photographic school but we were not out to foster the following of any particular school whether modern or academic; it was just 'great fun' to try and put on paper life as we knew it. The result is a great diversity. The speed at which some became technically advanced was surprising; certain of them producing drawings which would have gained them entrance into an English art school. For these the struggle to be themselves and not to imitate the European has been doubly hard; but that they are winning through can be seen by anyone who has watched their work grow. Others seemed to be able to retain an unsophisticated approach to art in spite of their sophistication in other branches of life. Those who know the African will recognise much that is strong in African life; the love of cattle which is the heart of so much of their culture; the terror at night when a hut

goes up in flames, the clear hot atmosphere at the coast, the solidity of the banana palms.

"The second group is all the work of young teachers at the Church Missionary Society's girls' school at Gazaya: working under Miss Fisher. Here again the initial difficulty was to overcome the girls' fear of laughter at their efforts. In a girls' school where great attention is paid to needlework and design, where the brightly-coloured cotton piece goods from Japan are worn and appreciated, it is natural that a brighter, more decorative tradition has sprung up, which is not seen in the work of the two other groups. The Gazaya work has the same colourful qualities as that of Professor Chesik's Austrian children. One outstanding picture, 'Jesus on the hill,' depicting a native figure on a hill-top at dusk, has a primitive beauty that is almost startling in its sincerity of purpose and shows that the decorative tradition can be discarded at will.

"That the African has an innate sense of rhythm, colour and design, can be seen from this collection of pictures; exactly how this will develop is not clear; nor is it desirable that it should be clear at this stage; all attempts to build up a stylised tradition at such a date are strongly to be deprecated."

Empire and G.P.O. Film Libraries.—The Libraries now possess over 2,000 prints, which total has been reached by the receipt of 120 additional films since the end of March. Included in these are 37 new subjects, received from the following countries: United Kingdom (11); Canada (13); South Africa (1); Ceylon (4); British East Africa (2); British West Africa (1); Malaya (3); and the West Indies (2).

Among the United Kingdom films the subjects dealt with comprise scenery, industry, history and housing.

The Canadian films cover such subjects as mining, agriculture, industry, travel, sport, and interesting animal studies in the National Parks.

The film from South Africa deals with the diamond industry.

"The Song of Ceylon" shows the life and customs of the people of the island, whilst "Jungle Gods" depicts the luxuriant tropical beauty of the Colony.

From East Africa films dealing with wild life and with Kenya coffee have been added, whilst from West Africa "Presta Gold Mine" (Gold Coast) has been included.

Coconuts and copra, rice and rubber are the subjects of

the Malaya films, and the new West Indian subjects dealt with are sugar (Trinidad) and asphalt.

Cinema Hall.—Up to and including Saturday, April 29, four sessions of films had been held daily and two on Sundays. As from April 30 this was altered to two sessions from 10.15 to 12.15 and from 2.15 to 4.15 daily and on Sundays a continuous programme from 2.45 to 5.45. The following lectures were arranged for delivery in the Cinema Hall up to the end of June: "New Zealand—The Wonderland of the Pacific," Mr. Arthur J. Bland; "Zanzibar and its Cloves," Mr. A. J. Findlay, C.M.G.; "A Gem of the Caribbees," Mr. G. H. Inniss; "A General Talk on Kenya," Mr. John Williamson; "Life in Nigeria," Mr. S. U. Etuk; "Over the Khyber to Calcutta," Dr. W. C. Bentall, O.B.E.; "How South African Oranges are Grown," Commander the Hon. Sereld Hay, O.B.E., R.N. (Retd.).

Colonial Visitors.—The following is a list of officers on leave from the Colonies, etc., who have visited the Institute during the three months February-April 1939.

February

E. Bateson, lately Mycologist and Agricultural Adviser, North Borneo.
C. W. Benson, Assistant District Officer, Nyasaland.
H. E. Harbour, Veterinary Officer, Tanganyika Territory.
G. E. London, C.M.G., Colonial Secretary, Gold Coast.
J. N. Milsum, Senior Agricultural Officer, Federated Malay States.
M. A. Molloy, Veterinary Officer, Tanganyika Territory.
E. G. Pattle, Commissioner, Burma Civil Service.
P. C. Randell, Assistant Conservator of Forests, Nigeria.
D. Rhind, Economic Botanist, Burma Agricultural Service.
E. W. Rossiter, Assistant Superintendent, Burma Frontier Service.
L. F. F. W. Streit, Inspector of Mines, Tanganyika Territory.
Dr. G. J. Williams, Geologist, Tanganyika Geological Survey.

March

V. A. Beckley, M.C., Senior Agricultural Chemist, Department of Agriculture, Kenya.
W. E. T. Bond, Agricultural Officer, Nigeria.
Dr. F. Dixey, O.B.E., Director, Geological Survey, Nyasaland.
F. H. Geake, Chemist, Customs and Excise, Malaya.
C. W. Knight, Ex. Engineer, Cochin Harbour.
A. K. F. Nicol, Assistant Conservator of Forests, Nigeria.
H. D. Noone, Field Ethnographer, Museums, Federated Malay States.
J. D. Tallantire, Agricultural Officer, Gambia.

April

M. Akenhead, Agricultural Superintendent, Gold Coast.
G. G. Auchinleck, Director of Agriculture, Gold Coast.
W. E. Freeman, Botanist, Department of Agriculture, Nigeria.

April (*continued*)

W. F. Gwilliam, Agricultural Officer, Nigeria.
Captain E. F. G. Haig, Administrative Service, Nigeria.
Dr. C. S. Hitchen, Geologist, Geological Survey, Kenya.
W. Johnston, Colonial Secretary and Financial Secretary, British Honduras.
W. D. Raymond, Government Analyst, Tanganyika Territory.
H. Service, Geologist, Geological Survey, Federated Malay States.
J. Shelton, Chief Chemist, Institute for Medical Research, Kuala Lumpur, Federated Malay States.
J. R. P. Soper, Agricultural Officer, M.A.S., Straits Settlements.
H. R. Surridge, Agricultural Officer, Fiji.
C. T. Thomas, Inspector of Mines, Federated Malay States.
J. H. Ward, Instructor-in-Stock, Department of Veterinary Services, Research Laboratory, Kenya.

All Dominion and Colonial officers, as well as private residents overseas, who may be visiting London are cordially invited to come to the Institute to see our Exhibition Galleries, and to discuss scientific and technical problems in which they may be interested.

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CONTACTS WITH COLONIAL GOVERNMENT OFFICERS

By SIR HARRY LINDSAY, K.C.I.E., C.B.E.
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READERS of the BULLETIN will have noticed that in recent issues we have published a list of officers on leave from the Colonies who have visited the Imperial Institute each month. The value of these visits cannot be over-emphasised. They serve a two-fold object. In the first place they offer an opportunity for the officers to see for themselves the work we are endeavouring to carry out for the Empire, to discuss measures for improving the exhibits pertaining to their Colony and for increasing the usefulness of our Film Library. And secondly, and this by no means the least important, they bring the technical officer from overseas into personal contact with our scientific staff, enabling him to discuss his own problems at first hand with those actually concerned with the investigations and intelligence work carried out at the Imperial Institute. That these visits are appreciated by the officers themselves is evident from the increasing numbers who come here. Reference to the list in the present issue (p. 510) will show that in June alone 31 Government officials from the Colonies visited the Institute, of whom the majority were connected with technical departments. To illustrate the value of these personal contacts the following recent examples of interviews with officers of the Agricultural Departments may be cited.

Dr. G. Griffith, of the Agricultural Department, Uganda, was proceeding to take up an appointment as Soil Chemist

to the Malayan Department of Agriculture and it was possible to discuss with him at length certain aspects of the cultivation of the Malayan crop derris, which is not grown in Uganda, and also of Manila hemp which is being taken up experimentally in Malaya.

The visit of Mr. D. Sturdy, Senior Agricultural Officer, Tanganyika Territory, gave an opportunity of discussing papain (samples of which he had sent to the Institute for examination previously), beeswax and soya beans.

Mr. S. Gillett, Agricultural Officer, Kenya, is paying an official visit to Central and South America, to inquire into the present methods employed in the coffee industries and to investigate lines of research that are conducted there. He was given assistance in connection with his itinerary, and the work he is doing in Kenya on crop yields and quality in coffee was also discussed with him.

Mr. L. H. Saunders, Acting Senior Agricultural Superintendent, Gambia, is concerned with livestock as well as crop questions in that Colony. On the occasion of his visit matters relating to goat and sheep skins and to clarified butter (ghee) were discussed and also the production of palm kernels.

Mr. V. A. Beckley, Senior Agricultural Chemist, Kenya, raised many matters of mutual interest, of which pyrethrum and essential oils may be specially mentioned. The monograph on Insecticides of Vegetable Origin in course of preparation at the Institute was discussed and Mr. Beckley was able to render useful service in obtaining certain information required in connection with the Kenya pyrethrum industry.

Interesting discussions took place with Dr. R. R. Le G. Worsley, Biochemist, East African Agricultural Research Station, on derris and other rotenone-containing plants; with Mr. B. G. G. Charles, Agricultural Officer, Nyasaland, on tung plantations and tung oil expression; and with Mr. H. C. Doyne, Senior Agricultural Chemist, Nigeria, on the work done at the Institute on Nigerian ginger, which formed the subject of a report in the previous issue of this BULLETIN.

Advantage is also taken of the presence of technical officers in this country to invite them to meetings of our Consultative Committees, at which matters of interest to them are to be considered, and in some instances meetings have been specially arranged to this end.

PLANT AND ANIMAL PRODUCTS

REPORTS OF RECENT INVESTIGATIONS AT THE IMPERIAL INSTITUTE

Selected from the Reports made to the Dominion, Indian and Colonial Governments

MANGROVE WOODS FROM TANGANYIKA FOR PAPER-MAKING

IN view of the large quantities of mangrove wood available in different parts of the tropics the question has been raised from time to time as to the possibility of utilising it as a source of paper-pulp. Recently, in response to a request for information on the subject, the Commissioner, H.M. Eastern African Dependencies Trade and Information Office, was supplied with such particulars as were available and subsequently he sent for examination samples of three kinds of mangrove wood occurring in Tanganyika. These were submitted to detailed tests in the paper-making laboratory of the Institute and although the materials proved to be not altogether satisfactory for paper-making, it is thought worth while putting the results on record in view of the relative scarcity of published information on the subject. The samples were submitted under their native names and the results of their examination are given separately below.

The method employed in the examination of the woods was the same in each case. A representative portion of the sample was finely ground and submitted to chemical examination, and the amounts of moisture, resins, cellulose and ash determined; in two of the cases the alkali solubility was also determined. Ultimate fibres were prepared from the woods

and examined microscopically, the dimensions of the fibres being determined by a projection microscope.

For the actual paper-making trials the wood was first converted into chips by sawing ¾ in. discs from the logs at intervals along their length and reducing these sections to chips. The chips were then cooked in a rotary digester under conditions approximating to those employed commercially for the production of soda pulp. Owing to the nature of the woods only the soda process was employed. The cooking conditions, soda consumption and yields of unbleached pulps, were recorded in each case.

The pulps obtained were then submitted to a series of bleaching tests, using varying ratios of standard bleaching powder (bleaching powder containing 35 per cent. of available chlorine) to pulp. All the tests were made at 5 per cent. consistency and at room temperature.

Finally, in order to evaluate the strength and general quality of the unbeaten pulps produced in the various cooking trials, standard sheets were prepared by means of the British Standard Sheet Machine, using the official method described in the Second Report of the Pulp Evaluation Committee of the Paper Makers' Association. The sheets were dried and conditioned overnight at 70° F. and 65 per cent. relative humidity prior to testing, which was carried out according to the Paper Makers' Association's official methods. Beating trials were also carried out where this seemed to be desirable.

1. Makandaa Wood

" Makandaa " is the Swahili term for a variety of mangrove stated to be *Ceriops candolleana* Arn. The sample received consisted of a single log, weighing 44 lb., from which the bark had been removed. It measured 4 ft. in length, and varied from 5 to 6 in. in diameter. The wood, which was a warm reddish-brown in colour, was hard and of high density.

Results of Examination

Chemical Examination.—This wood gave the following results :

	Expressed on the wood as received.	Expressed on moisture-free wood.
	Per cent.	*Per cent.*
Moisture	7·7	—
Resins (material soluble in alcohol-benzene)	8·8	9·5
Alkali solubility (by Schorger's method)	23·6	25·6
Cellulose	45·3	49·1
Ash	1·0	1·1

From these results it will be seen that the present sample of "Makandaa" wood contained the extremely high proportion from a paper-making point of view, of 9·5 per cent. (on a moisture-free basis) of resinous material extractable in alcohol-benzene. The cellulose content of the wood was rather lower than that of the woods in commercial use for paper manufacture.

Microscopy of the Ultimate Fibres.—The ultimate fibres were found to be rather short, with thick walls and narrow lumens. Small cells and large, thin-walled, finely marked vessels were also present. The dimensions of the fibres were as follows:

	Maximum.	Minimum.	Average.
	mm.	*mm.*	*mm.*
Length . .	1·6	0·7	1·4
Width . .	0·033	0·011	0·021

The present wood falls into the class of short-fibred materials which are only capable of filling a minor rôle in paper-making. Such short-fibred materials are normally used as bleached pulps and find their chief outlet as filler pulps for incorporation with stronger, longer-fibred materials in the manufacture of printing and writing papers.

Paper-making Trials.—The high colour of the present wood and its exceptionally large resin content render it unsuitable either for pulping by the sulphite process or for grinding to yield a mechanical wood pulp. The possibilities of pulping the material are confined to alkaline cooking processes, and accordingly, for the present paper-making trials at the Imperial Institute, the soda process was employed.

The wood chipped up readily and was fairly free from knots. The chips were carefully sorted, discarding small fragments and over-sized pieces, to yield a uniform product consisting of chips measuring approximately $\frac{3}{4}$ in. long, $\frac{3}{4}$ in. wide and $\frac{1}{16}$ in. thick.

The results of the cooking trials are given in the following table:

	Digestion No.		
	N.014.	N.015.	N.016.
Conditions of digestion:			
Maximum temperature . .	160° C.	170° C.	165° C.
Time at maximum temperature	5 hrs.	5 hrs.	7 hrs.
Strength of caustic soda solution . . *per cent.*	4	4	5
Parts of caustic soda per 100 parts of moisture-free wood	20	24	30
Parts of caustic soda consumed per 100 parts of moisture-free wood	14·4	17·0	16·0
Yield of moisture-free unbleached pulp (expressed on moisture-free wood) . . *per cent.*	38·9	33·9	32·8

It will be observed from these results that the highest yield of pulp obtained was reached in digestion N.014 with a figure of 38·9 per cent. This value is, however, below the yields obtained commercially in the digestion of deciduous hardwoods (e.g. aspen, *Populus tremuloides*) by the soda process. Moreover, the pulp obtained in digestion N.014 was slightly undercooked, giving a somewhat "shivy" standard sheet and proving very resistant to bleaching. When, in order to obtain a fully cooked bleachable pulp, more drastic cooking conditions were employed in digestions N.015 and N.016, the yields of unbleached pulp fell to the very low values of 33·9 per cent. and 32·8 per cent. respectively, and such figures must be regarded as very poor yields.

Bleaching Trials.—The following results were obtained:

Digestion No.	Results.
N.014 .	Pulp unbleached even by 40 per cent. of standard bleach, expressed on the weight of moisture-free pulp.
N.015 .	Pulp bleached to a cream colour with 30 per cent. of standard bleach, expressed on the weight of moisture-free pulp.
N.016 .	Pulp bleached to a cream colour with 30 per cent. of standard bleach, expressed on the weight of moisture-free pulp.

Although pulps N.015 and N.016 proved bleachable to a fairly good colour, the quantity of bleach they required was in excess of that which it would be economic to employ in practice.

A larger quantity of pulp N.015 was also bleached in order to determine the bleaching yield and to obtain pulp from which to make standard sheets of bleached paper. The yield

of bleached pulp amounted to 29·9 per cent. of the weight of the moisture-free wood.

Pulp Evaluation.—The results of the tests on the standard sheets prepared from the " Makandaa " pulp are given in the following table :

	Digestion No.			
	N.014.	N.015.	N.016.	N.015B (bleached).
Basic weight *grams per sq. metre*	61·7	59·4	62·5	61·4
Thickness *microns*	162	143	158	131
Bulk *c.c. per gram*	2·6	2·4	2·5	2·1
Burst factor *grams per sq. cm.*	6·2	8·4	8·5	13·3
Breaking length *metres*	1920	2300	2320	2970
Stretch *per cent.*	0·6	0·8	0·7	1·4
Remarks . .	Slightly shivy. Good formation. Very weak, soft paper. Darkbrown colour.	No shive. Good formation. Very weak, soft paper. Darkbrown colour.	No shive. Good formation. Very weak, soft paper. Darkbrown colour.	No shive. Good formation. Very weak, soft paper. Creamy-white colour, slightly inferior in colour to commercial bleached soda pulp from poplar. Very transparent.

The pulp evaluation figures given above show the pulps obtained from " Makandaa " wood to be of low strength. The rather higher values for the bleached pulp N.015B are probably to be attributed to a slight beating effect arising from the additional treatment involved in the bleaching process.

An investigation of the effect of beating on the strength of the pulps was not undertaken in view of the poor yields of pulp obtainable.

Remarks

Judging from the present sample, " Makandaa " (*Ceriops candolleana* Arn.) is a highly-coloured wood containing 9·5 per cent. of resins on a moisture-free basis, and consequently only suitable for pulping by alkaline digestion processes. Laboratory cooking trials showed that the yield of pulp obtainable was very low, and this fact, in conjunction with the short-fibred nature of the pulp, its high bleach demand and poor strength, renders the wood of very low value as a raw material for paper manufacture. It is not likely that commercial exploitation of the material for this purpose would be profitable in East Africa.

2. Mchuu Wood

"Mchuu" is the Swahili term for the mangrove tree which is botanically known as *Avicennia officinalis.* The sample consisted of a single log weighing 50 lb. and measuring about 3 ft. in length and 9 in. in diameter. In general the colour of the wood varied from pale yellowish-brown to pale grey; the wood was, however, much stained. In transverse section the large vessels regularly arranged along the limits of the seasonal rings were filled with fungal hyphae. Large areas of the wood were generally affected by fungus. In addition there were present irregularly-shaped, deeply pigmented patches, almost black in transverse section but deep orange brown to dark brown in longitudinal section. These last dark-coloured patches were usually associated with a crack or cavity in the timber. The wood was of high density and moderately hard.

Results of Examination

Chemical Examination.—The results obtained are given in the following table:

	Expressed on the wood as received.	Expressed on moisture-free wood.
	Per cent.	*Per cent.*
Moisture	8·0	—
Resins (material soluble in alcohol-benzene)	1·4	1·5
Alkali solubility (by Schorger's method)	15·4	16·7
Cellulose	50·3	54·7
Ash	2·1	2·3

From these results it will be seen that the present sample of "Mchuu" wood contained a moderately high proportion of cellulose, viz., 54·7 per cent. expressed on the moisture-free wood. The percentage of resinous material extractable with alcohol-benzene was, moreover, satisfactory low.

Microscopy of the Ultimate Fibres.—The ultimate fibres prepared from the wood were found to be short, with gradually tapering ends, and lumens which varied in width with corresponding variations in the wall thickness of the fibres. Many of the fibres possessed somewhat serrated edges, and an occasional fibre with a forked end could be observed. Small cells were very numerous, and finely marked vessels, usually of rectangular shape, were also present.

The dimensions of the fibres were as follows :

	Maximum. *mm.*	Minimum. *mm.*	Average. *mm.*
Length . .	1·3	0·4	1·0
Width . .	0·030	0·011	0·020

This wood, like "Makandaa," falls in the class of short-fibred materials which are only of minor importance in paper-making (see p. 333).

Paper-making Trials.—Owing to the low fibre length of the present wood the possibilities of pulping the material are confined to the soda process, and accordingly in the present paper-making trials at the Imperial Institute this process alone was employed.

The wood chipped up badly, even by laboratory methods, and, failing to cut cleanly, it crumbled, fractured unevenly and yielded a large amount of waste. Chipping on a commercial scale would probably prove extremely wasteful. The chips were sorted to yield a product consisting of chips measuring approximately $\frac{3}{4}$ in. long, $\frac{3}{4}$ in. wide and $\frac{3}{16}$ in. thick.

The results of the cooking trials were as follows :

	Digestion No. N.017.	N.018.	N.019.
Conditions of digestion :			
Maximum temperature . .	160° C.	170° C.	170° C.
Time at maximum temperature	5 hrs.	5 hrs.	5 hrs.
Strength of caustic soda solution . . *per cent.*	4	4	5
Parts of caustic soda per 100 parts of moisture-free wood	24	24	30
Parts of caustic soda consumed per 100 parts of moisture-free wood	14·8	17·0	19·1
Yield of moisture-free unbleached pulp (expressed on moisture-free wood) . . *per cent.*	42·1	38·6	36·1

The wood was found to be readily pulped by the soda process, even the mild conditions employed in digestion N.017 giving a thoroughly well-broken-down pulp completely free from shive. The yield obtained in cook N.017 reached the moderately good value of 42·1 per cent. of moisture-free unbleached pulp expressed on the weight of moisture-free wood. The more drastic conditions employed in cooks N.018 and N.019 which were carried out in an endeavour to prepare "easy-bleaching" pulps, reduced the yields to 38·6 per cent. and 36·1 per cent. respectively—values which are so low that it is doubtful if they would be economically practicable.

Bleaching Trials.—The following results were obtained :

Digestion No.	Results.
N.017 .	Pulp not fully bleached by 40 per cent. of standard bleach expressed on the weight of moisture-free pulp.
N.018 .	Pulp bleached to a good white with 40 per cent. of standard bleach, expressed on the weight of moisture-free pulp.
N.019 .	Pulp bleached to a good white with 30 per cent. of standard bleach, expressed on the weight of moisture-free pulp.

It is evident from these figures that the quantity of bleach required by the pulps was very much in excess of the amount which it would be economic to employ in practice.

A two-stage bleaching experiment on N.019 gave a rather better result. In the first stage, 12½ per cent. of standard bleach was employed under slightly acid conditions. The partially bleached pulp was then thoroughly washed with water, dilute alkali, and finally water again. The yield of semi-bleached pulp was 89·5 per cent. of the weight of unbleached pulp, i.e. only 32·3 per cent. expressed on the moisture-free wood. In the second stage ordinary calcium hypochlorite bleaching was used, and a series of trials showed that 7½ per cent. of standard bleach would produce a pulp of excellent whiteness. The total bleach used in the two-stage process was thus 20 per cent. Even this figure must be considered to be too high, especially in view of the very low yield.

Pulp Evaluation.—The results of the tests carried out on the standard sheets are given in the following table :

	Digestion No.	
	N.017.	N.018.
Basic weight *grams per sq. metre*	58·8	61·2
Thickness . *microns*	137	137
Bulk . *c.c. per gram*	2·3	2·2
Burst factor *grams per sq. cm.*	7·9	8·9
Breaking length *metres*	2340	2550
Stretch . *per cent.*	0·8	1·0
Remarks . . .	Very weak, soft paper of dark brown colour. Well-formed sheets free from shive, but contaminated with numerous small brown specks.	Very similar to N.017.

The foregoing evaluation figures show that the present sample of "Mchuu" wood yielded only a very weak pulp.

The small brown specks in the paper were very numerous, and were evidently derived from the pigmented portions of the wood mentioned earlier in this report. Although unaffected by the digestion processes, the pigment associated with these specks was destroyed in the bleaching trials: their presence may, however, have largely contributed to the difficulty of bleaching the pulps.

Remarks

The present investigation has shown that

(*a*) Mchuu wood is a short-fibred material belonging to the class of woods such as aspen (*Populus tremuloides*), which find little outlet in paper-making except in the form of bleached soda pulps.

(*b*) The wood is easily digested by the soda process, but does not yield an easily bleachable pulp, the bleach consumption being excessive even when a two-stage process is employed. Efforts to reduce the bleach consumption by using more drastic cooking conditions were unsuccessful, as the yield of pulp fell below the figure which would be economically practicable.

(*c*) The sample chipped up badly and produced a large proportion of waste. It may be added that according to Dale (*Zeit. für Weltforstwirtschaft*, 1938, **5**, No. 6, 418) *Avicennia officinalis* wood rots rapidly.

3. Makaka Wood

This material was named "Makaka" and was stated to be derived from *Rhizophora mucronata*; the Swahili term for *R. mucronata* is "Mkoko," which is a somewhat similar word to "Makaka." The sample consisted of a single log from which the bark had been removed. It weighed 39 lb. and measured 4 ft. in length and from 5 to 6 in. in diameter. The wood, which was of a warm reddish-brown colour, was hard and of high density.

Results of Examination.

Chemical Examination.—The wood gave the following results on examination:

	Expressed on the wood as received.	Expressed on moisture-free wood.
	Per cent.	*Per cent.*
Moisture	7·6	—
Resins (material soluble in alcohol-benzene)	4·1	4·4
Cellulose	58·6	63·4
Ash	1·4	1·5

From the analytical data given above it will be seen that the present sample of Makaka wood (*Rhizophora mucronata*) contains a very satisfactorily high percentage of cellulose. The resin content of the wood is high from a paper-making point of view and this fact, in conjunction with the rather high colour of the material, renders it unsuitable either for pulping by the ordinary sulphite process or for grinding to yield a mechanical pulp. The possibilities of pulping the material are consequently confined to alkaline cooking processes and accordingly, in the laboratory paper-making trials undertaken during the course of the present investigation, the soda process has been employed.

Microscopy of the Ultimate Fibres.—In appearance the ultimate fibres were rather short, tapering gradually to a pointed end. The lumens were fine and the cell walls thick, so that the fibres possessed a bold, tubular, rather than a ribbon-like appearance. Small cells and relatively large, thin-walled, finely marked vessels were also present.

The dimensions of the fibres were as follows :

	Minimum.	Maximum.	Average.
	mm.	*mm.*	*mm.*
Length	0·8	2·1	1·5
Width	0·016	0·043	0·026

It will be seen from the foregoing figures that Makaka wood, like the two other woods examined, falls in the class of short-fibred materials which are only capable of filling a minor rôle in paper-making (see p. 333).

Paper-making Trials.—For the reasons already outlined, the laboratory paper-making trials were confined to cooks by the soda process.

The chips prepared from the wood were carefully sorted free from small fragments and over-sized pieces to yield a uniform product consisting of chips measuring approximately

$\frac{3}{4}$ in. long by $\frac{3}{4}$ in. wide by $\frac{3}{16}$ in. thick. The wood chipped up readily and was fairly free from knots.

The results of the cooking trials are given in the following table :

	Digestion No. N.011.	N.012.	N.013.
Conditions of digestion :			
Maximum temperature . .	160° C.	170° C.	170° C.
Time at maximum temperature	5 hrs.	5 hrs.	5 hrs.
Strength of caustic soda solution . . *per cent.*	4	4	5
Parts of caustic soda per 100 parts of moisture-free wood	24	24	30
Parts of caustic soda consumed per 100 parts of moisture-free wood	15·4	16·7	19·2
Yield of moisture-free unbleached pulp (expressed on moisture-free wood) . . *per cent.*	47·5	44·7	39·6

The wood was found to pulp readily by the soda process and even the mild conditions of digestion employed in cook N.011 gave a thoroughly broken-down pulp, completely free from shive. The yield of unbleached pulp resulting from cook N.011 amounted to 47·5 per cent. (expressed as moisture-free pulp on the moisture-free wood), a very satisfactory value which is considerably above the highest yields that could be obtained from the two other samples of Tanganyika mangrove wood, Makandaa (*Ceriops candolleana*) and Mchuu (*Avicennia officinalis*), examined.

The more drastic conditions N.012 and N.013 were carried out in an endeavour to produce a readily bleachable pulp. It will be noted that the more severe conditions employed in these two boils have seriously reduced the yields of unbleached pulp, which have fallen to the values of 44·7 and 39·6 per cent. respectively.

Bleaching Trials.—Preliminary small-scale tests indicated that pulp N.011 could not be bleached with a reasonable quantity of bleach solution. Digestions N.012 and N.013 were accordingly carried out in an endeavour, by employing more drastic cooking conditions, to remove more of the non-cellulosic impurities and thus reduce the bleach demand of the pulp. Pulp N.012 was found to require 20 per cent. of standard bleaching powder, but the colour of the bleached pulp was poor, being of a dark cream shade. Despite the severity of the cooking conditions and the serious reduction in the yield,

the pulp obtained from digestion N.013 was not appreciably more easily bleached than was pulp N.012. It was evident, therefore, that the employment of even more drastic digestion conditions would be useless and would merely result in a reduced yield of pulp without a corresponding improvement in its bleachability.

It may be mentioned that Vidal and Aribert (*L' Agronomie Coloniale*, June 1928) experienced a similar difficulty in bleaching soda pulp which they had prepared from *Rhizophora mucronata* grown in Madagascar. These workers obtained a yield of 47 per cent. of unbleached pulp, the bleaching of which they describe as prolonged and difficult. Even by the use of 25 per cent. of standard bleach in a two-stage process at 35°-40° C. the bleached pulp they prepared was only of transient whiteness, gradually assuming a yellowish tinge on exposure to the air. Their yield of bleached pulp was 42 per cent.

It is possible that a two-stage digestion process on the lines of the Raitt process as applied to bamboo might permit of the production of a more readily bleachable pulp from Makaka wood. The pulp obtainable from the wood is not, however, of high value for paper-making, and under existing trade conditions it must be considered very doubtful whether paper manufacturers would consider that the material justified any departure from the simplest pulping and bleaching methods.

Pulp Evaluation.—The results of the tests carried out on the standard sheets are given in the following table:

	Digestion No.			
	N.011 Unbeaten.	N.011 Beaten. 7,000 revs.	N.011 Beaten. 14,000 revs.	N.012 Unbeaten.
Basis weight *grams per sq. metre*	59·7	60·7	57·5	58·1
Thickness *microns*	163	114	91	153
Bulk *c.c. per gram*	2·7	1·9	1·6	2·6
Burst factor *grams per sq. cm.*	4·1	20·4	26·6	4·4
Breaking length *metres*	1500	4120	5160	1610
Stretch *per cent.*	0·5	1·7	2·2	0·7
Remarks . .	Very weak, soft paper of deep brown colour. Sheets well formed but of a loose, spongy texture. No shive.	Well closed, evenly-formed sheets, denser and of better strength than the unbeaten paper from N.011.	Similar to N.011 beaten 7,000 revs., but more "rattly" and slightly stronger.	Similar to N.011 unbeaten.

From the figures given above it will be seen that the standard sheets prepared from the unbeaten, unbleached pulps N.011 and N.012 are of very poor strength.

Beating experiments were carried out on N.011 and the results of these trials are also included in the foregoing table. A Lampén mill was used for the determination of the beating effect and the P.M.A. Tentative Method for the Evaluation of Beating Effect was followed. Very severe hammering occurred during the beating of the pulp in the Lampén mill.

It will be seen from the figures for the evaluation of the beaten pulps that beating is capable of effecting a considerable improvement in the strength of the pulp. Nevertheless it is clear, from these figures and from an examination of the standard sheets, that this species of mangrove wood would not be capable of yielding an unbleached pulp of sufficient strength for the manufacture of wrapping papers.

Remarks

The following conclusions are drawn from the foregoing investigation :

(1) Makaka (*Rhizophora mucronata*) wood has an average fibre length of 1·5 mm. and a high cellulose content, and is superior in both these respects to the two other species of Tanganyika mangrove wood, viz. Makandaa (*Ceriops candolleana*) and Mchuu (*Avicennia officinalis*), examined.

(2) On account of its resin content and high colour, Makaka would only be suitable for pulping by the alkaline digestion processes.

(3) The wood gives a good yield (47·5 per cent. on a moisture-free basis) of unbleached soda pulp, but the pulp is too weak and short-fibred to be suitable for the manufacture of unbleached wrapping papers.

(4) Soda pulp from Makaka is not easily bleached, and in spite of the employment of severe cooking conditions it was not found possible to prepare a pulp which bleached readily to a good white.

As already mentioned, short-fibred soda pulps are relatively only of minor importance in paper-making ; they are chiefly

used in the bleached state as filler pulps for mixing with stronger, longer-fibred pulps in the manufacture of writing and printing papers. The utilisation of Makaka pulp in a similar field is obstructed by the difficulty of bleaching the pulp satisfactorily, and although modifications of the normal pulping and bleaching processes might yield a more easily bleachable pulp, it is very doubtful whether, in view of the low value and limited field of use of the pulp, such measures would be justified.

It is therefore unlikely that a profitable outlet could be found for Makaka wood as a raw material for paper-making.

NIGERIAN GOAT AND SHEEP SKINS

In connection with the scheme of goat and sheep improvement undertaken by the Nigerian Veterinary Department, which aims at breeding only the more valuable animals to the exclusion of the inferior types, a series of goat and sheep skins was submitted early in 1938 to the Imperial Institute for report on their respective characters and market values. In all, 1,200 goat skins and 500 sheep skins were received. Of these, 25 goats and 5 sheep skins were withdrawn for exhibition purposes and the remaining 1,175 goat and 495 sheep skins were used for the present investigation.

Goat Skins

The 1,175 skins examined were as follows:

Mark.	Origin.	Description.	Number of Skins.
K	Kano Province	Red	100
3	,, ,,	Black	100
6	,, ,,	White	100
12	,, ,,	Cross-bred	100
S.12	Sokoto Province	Red	90
S.13	,, ,,	Buguruwa	100
S.14	,, ,,	Black	100
S.15	,, ,,	Tchaga	100
C.6	Katsina Province	Red (Jar Akura)	100
C.7	,, ,,	Red (Saiwa)	100
C.8	,, ,,	Hairy (Buguruwa)	100
B.113	Bornu Province	Common type	85
			1,175

The skins on arrival at the Imperial Institute were in good condition and free from insects. In the raw state they appeared to have been well taken off and prepared.

The skins were tanned and dressed as black glazed kid by a firm of tanners represented on the Imperial Institute Consultative Committee on Hides and Skins, who reported as follows:

The out-turn figures of leather produced and selling prices of the leather are quoted below:

Mark.	Origin.	Description.	Average feet per dozen skins in leather.	Sale price of leather, pence per foot.
K	Kano Province .	Red . .	51¾	8·90
3	,, ,, .	Black . .	55	8·32
6	,, ,, .	White . .	58¾	6·50
12	,, ,, .	Cross-bred .	53¾	7·47
S.12	Sokoto Province .	Red . .	56	8·00
S.13	,, ,, .	Buguruwa .	56	8·48
S.14	,, ,, .	Black . .	54¼	7·97
S.15	,, ,, .	Tchaga . .	61	7·59
C.6	Katsina Province	Red (Jar Akura)	42½	6·50
C.7	,, ,,	Red (Saiwa) .	40½	6·00
C.8	,, ,,	Hairy (Buguruwa)	42¼	7·45
B.113	Bornu Province .	Common type .	60	6·82

Kanos.—The Reds were of excellent quality, and upon dressing the out-turn was superior to a commercial delivery of Kanos. The Blacks were also very good; a little larger than the Reds, this is usual, but the quality was excellent. The White and Cross-breds were also very good for their description; the Cross-breds were superior to a delivery of F.A.Q. of these goods, but the measurement was a little smaller than usual.

From the out-turn sale figures of these Kanos (8·90*d.* per ft. for the Reds and 6·50*d.* per ft. for the Whites) the importance of keeping the strain confined to the Reds is seen.

Sokotos.—The out-turn of these is disappointing. The skins appeared to be quite a good parcel when seen in the raw, but this was not borne out when manufactured. It will be seen that the best result of the Sokotos (8·48*d.* for the Buguruwas) is below that for the Red Kanos (8·90*d.*) although the Raw Sokotos cost ¾*d.* per ft. more than did the Kanos.

It will be seen, however, that the Red skins do show a better return than the Blacks and coloured skins.

Katsina.—The out-turn of these is very poor—a considerable loss is shown on their manufacture. This is almost entirely due to the large amount of damage done to the skins by scratches.

The out-turn of the Hairy description of these skins is 1*d*. per ft. above that of the Red, presumably due to the protection given to the animals' skin by the thicker fleece.

Bornu.—The out-turn of these again is above that of the usual commercial parcels; the superior result seems to be due to the absence of a few skins of a very inferior description that are generally present in parcels from this district.

Sheep Skins

The consignment consisted of the following skins:

Mark.	Origin.	Description.	Number of Skins.
1	Kano Province	Long-haired	100
2	,, ,,	Short-haired	100
S.16	Sokoto Province	White	100
S.17	,, ,,	Bayudi	100
B.112	Bornu Province	Common type	95
			495

The skins were received at the Imperial Institute in good condition, clean and free from insects. In the raw they appeared well flayed and prepared.

The skins were submitted for tanning trials to a firm of gloving leather manufacturers represented on the Imperial Institute Consultative Committee on Hides and Skins, who reported as follows:

The drying and preservation of the skins were satisfactory in all cases. The skins were tanned and dressed as suede glove leather. The details of the out-turn are shown in the table opposite.

NIGERIAN SHEEP SKINS

Mark.	Origin.	Description.	Raw skins.		White leather.	Dressed and finished leather.			Factors of value.		Combined factors.
			Appearance.	Average weight per dozen skins.	Feet per dozen skins.	Percentage sorting into grades according to quality.			Feet of leather per lb. of raw skin.	Quality of leather.	Relative value per lb. of raw skin.
				lb.		I.	II.	III.	A.	B.	A×B×10
1	Kano Province .	Long-haired .	Mixed colours. Flat, thin pelts .	22¾	83½	77½	14½	8	3·7	4·34	160
2	" " .	Short-haired .	Mixed colours. Flat, good pelts .	21½	97½	76	15	9	4·5	4·15	186
S.16	Sokoto Province .	White . .	White short hair. Excellent pelts, folded . .	21½	84	85	10½	4½	3·9	4·79	187
S.17	" " .	Bayudi . .	Belted, very fair, folded . .	20	86½	83	11½	5½	4·3	4·75	202
B.112	Bornu Province .	Common type .	Flat, very fair pelts . .	21	94½	75½	13½	11	4·5	4·22	190

The foregoing figures show the advantage which short-haired skins possess over long-haired skins in the yield of leather, i.e. feet of leather per lb. of raw skin.

It was particularly noticeable that the quality of the Bornus was greatly above that of average commercial shipments.

From the above results the types take the following order, according to the quality of the leather they produce: Sokoto White, Sokoto Bayudi, Kano Long Hair, Bornu, Kano Short Hair.

In addition to the quality of the leather produced, the value of sheep skins to the tanner is also dependent on the number of feet of finished leather which each lb. of raw skin yields. The combined factors, as given in the last column of the table, represent an assessment of the relative value per lb. of the raw skins of the various types. When the combined factors are considered the types take the following order: Sokoto Bayudi, Bornu, Sokoto White, Kano Short Hair, Kano Long Hair.

The last three columns of the table may be restated as relative figures with the highest value represented by 100 as follows:

Type of skin.	Feet of leather per lb. of raw skin. A.	Quality of leather. B.	Relative value per lb. of raw skin. A × B.
Kano, Long-haired	81	91	73
Kano, Short-haired	100	86	86
Sokoto, White	86	100	86
Sokoto, Bayudi	95	99	94
Bornu, Common	100	88	88

Conclusions

The results of the working trials with the goat and sheep skins were considered by the Imperial Institute Consultative Committee on Hides and Skins, their conclusions being as follows:

The values of the different types of skins forming the present consignment, from the point of view of the tanning industry, are given in the tanner's reports. In the case of the goat skins this takes the form of a statement of the selling price of the leather yielded by each type, and of the average number of feet of leather per dozen skins; in the case of the sheep skins the relative values of the types are seen from the factor values which are recorded.

With regard to the goat skins, which were all worked and dressed as black glazed kid, it will be seen that the Red Kano skins turned out better than the Red Sokotos, the leather being priced higher, and the Red Kano skins therefore recorded as of higher value than the Red Sokotos. In the trade generally, Red Sokotos are accepted as superior to Red Kanos and command a higher price. The result obtained in these trials may be due to the present lot of Red Kanos being superior to the usual commercial consignments, while the Sokotos proved disappointing in out-turn. On the other hand Red Sokotos are particularly esteemed in the industry for the manufacture of high-class coloured glazed kid, and it is possible that if tested against Red Kanos for this purpose the order of value now obtained might be reversed. Tanning and finishing as black glazed kid is a sound basis for comparison as Nigerian goat skins are largely used for that purpose, but as large quantities are also used for the manufacture of coloured kid leathers, it is desirable that the types should also be compared on the basis of their suitability for coloured glazed kid, and the Committee recommend that further consignments of the same types of goat skins be submitted for tanning trials for the production of coloured leather in order to obtain a complete assessment of their relative values.

The Red Katsina goat skins occupy a low position in the order of values, due almost entirely to the large amount of damage found on the grain caused by scratches. The Hairy Katsinas showed much less damage than the Red Katsinas. This gives rise to the question as to what extent the conditions of the district of origin are responsible for the quality of the skins, and, if it is true that in certain districts more thorny conditions prevail than elsewhere, whether a particular type of fleece, for instance, the Hairy Katsina, should be considered essential for such districts.

The Committee particularly drew attention to the advisability of interpreting the tanners' values recorded above for the present consignments of goat and sheep skins with due regard to the conditions of collection of the skins, information as to which will no doubt be possessed by the Veterinary Department. In the first place, since both the goat skins and sheep skins have in certain cases, as mentioned above, turned out differently to the usual commercial consignments of those

types, the cause of the difference may be due to collection not having been made from the general source; or the consignment may have been an unusual selection. All the factors of collection, such as the actual source of the skins, the season of purchase, and age of the animals, must be considered in deciding how truly the results of the present consignments represent the general run of each type of skin.

With regard to a decision as to which are the best types of skins to produce, it will, of course, be necessary to take into consideration the values of the skins as determined in this investigation, together with a number of other factors such as the general value of the animal, the particular conditions of a district, and the most suitable goat or sheep for those conditions.

ARTICLES

THE BRAZIL NUT

THE Brazil nut tree is indigenous to the Amazon basin, where it is known as "castanheira," the nut itself being called "castanha do Para." There seems to be some doubt as to the exact botanical origin of the tree and more work on this aspect of the matter is desirable, particularly from the point of view of the introduction of the most suitable form for cultivation in regions outside its natural habitat. The nut of commerce is commonly referred to as being derived from *Bertholletia excelsa* Humb. and Bonpl., but a second species, *B. nobilis* Miers, has also been described. The tree has been introduced into Ceylon and Malaya and botanical studies of the limited material available in those countries suggest that quite possibly only one species actually exists [1, 2, 3, 4]. Whether this is so or not, it seems quite likely, judging from the variation shown in the nuts coming from wild trees in Brazil, that cultivation of the tree would bring to light a number of different strains.

The tree is an evergreen and when mature may attain a height of 120-150 ft. and a diameter of 4-6 ft. The flowers are yellowish-white or cream in colour and have six petals with numerous stamens. The fruits vary from about 2½ to 5 lb. in weight and from 3 to 6 in. in diameter. A tough external envelope about ½ in. in thickness encloses anything

from 12 to 25 nuts, according to the size of the individual fruits. Within the fruit the nuts are borne in two concentrically arranged rows.

Trade in Brazil Nuts

The Brazil nut trade has roughly doubled since 1914. The United Kingdom and the United States are the chief consuming countries, production being almost entirely a Brazilian monopoly, though some nuts are obtained from Bolivia.

The following statistics of the Brazilian trade in this commodity for the quinquennium 1933-37 illustrate the present position and value of the industry.

Exports of Brazil Nuts from Brazil

Shelled	1933.	1934.	1935.	1936.	1937.
To—	*cwts.*	*cwts.*	*cwts.*	*cwts.*	*cwts.*
United Kingdom	32,921	1,243	1,583	2,549	—
United States	55,183	71,460	115,772	80,828	—
Other Countries	1,569	2,897	5,887	7,081	—
Total quantity (cwts.)	89,673	75,600	123,242	90,458	69,820
Total value (£)	201,363	207,467	456,450	567,123	404,000
Unshelled					
To—					
United Kingdom	351,899	300,730	290,439	266,536	—
United States	140,594	106,931	180,221	157,782	—
Germany	61,767	63,612	62,722	50,382	—
Other Countries	10,579	10,357	5,985	4,057	—
Total quantity (cwts.)	564,839	481,630	539,367	478,757	258,748
Total value (£)	533,078	437,619	516,032	605,201	600,000
Total value exports shelled and unshelled (£)	734,441	645,086	972,482	1,172,324	1,004,000

The Brazilian Industry

Brazil nuts are at present obtained almost exclusively from trees growing wild in the states of Para and Amazonas, in which there are a number of important producing districts. Several accounts of the Brazilian industry have already appeared [5, 6, 7, 8]. Either the trees and the land are in definite ownership, or else harvesting rights are owned. Little in the way of cultivation is normally undertaken, but in more recent years some attention has been directed to the establishment of plantations (see p. 354).

The tree grows naturally in clumps or groves in the forest, which occur normally at some distance from the waterways

as it does not thrive on swampy land. Some are found on raised ground close to the rivers.

In districts where the tree grows the temperatures recorded show little variation from month to month. At Manaos, over a period of ten years, the mean monthly temperature is given as 81° F., the mean monthly maximum and minimum temperatures as 90° F. and 75° F., and the absolute maximum and minimum as 102° F. and 66° F. The average annual rainfall for the same locality is 77 in.; the wettest months are from December to May.

Flowering occurs from October to December in Para and from November to January in Amazonas. Maturity of the fruits is reached from 13 to 15 months after flowering, and harvesting is normally in progress from January to April, i.e. during the rainy season, although it may extend a little longer. As the principal demand for the nuts in the United States and in Europe occurs at Christmas the bulk of the crop has to be stored for some months. However, in two producing districts, Acre and Rio Negro, the crop begins to fall in November, and these districts are thus able to market some of the new crop during the Christmas season.

The extent of the production is governed by the price of the nuts themselves, by the value of other Brazilian forest products, and lastly and perhaps above all by transport facilities. There appears to be a relatively unlimited number of trees in the forests, but collectors cannot profitably work more than a certain distance from the rivers as water transport is the only means of evacuating the produce. It is of economic importance that the harvest time, which occurs during the rainy months, does not coincide with the busy season of the rubber industry.

The labour force is usually paid on the basis of the quantity of nuts brought into the employer's homestead. A single worker may collect half a hectolitre (about 50 lb.) or more of nuts per day, and the payment may be on the basis of about half the value of the nuts. The labourers lead a nomad life, and wander through the forest in search of the fruits. On stormy or windy days it is considered unsafe to work under the trees on account of the size of falling fruits, and at such times the fruits previously collected are opened with a cutlass or rough hammer.

It is important to discard nuts damaged when the fruits are opened. If this is not done, and if such nuts are mixed with sound ones, fermentation may set in and a whole consignment may be ruined. Damaged nuts may be eaten, or used locally for oil making. It is also considered important to collect the fruits as soon as possible after these have fallen, as the crop tends to deteriorate if the fruits are left lying on the ground for any appreciable time during the wet weather that is experienced at the time of harvest.

On account of the size of the trees harvesting by picking unfallen fruits is impracticable, and as only fully ripe fruits fall no difficulty is experienced in the Brazil nut industry over the collection of immature nuts.

The annual yield obtainable from a mature tree has been given as from 200 to 400 fruits, or 220 lb. of nuts. However, a more optimistic statement suggests that a tree may produce 500 lb. or even 1,000 lb. of nuts in a single year.

Very little in the way of preparation or grading seems to be undertaken at the producing centres. After the fruits have been opened the nuts are spread out in the sun to dry, and may be washed and sieved according to size. In the washing process a quantity of nuts is usually placed in a basket which is then dipped into the river, when the bad nuts will float to the surface and can be eliminated. Grading is more commonly undertaken by the main exporters when the nuts reach such towns as Belem and Manaos.

The crop may be purchased in the interior by middlemen for ultimate sale to exporting merchants; the latter also maintain transport services on the rivers and buy direct from the producers. Various municipal and state taxes are payable on the crop exported.

Brazil nuts are classified according to size and district of origin. Three grades are recognised, which are of the following approximate dimensions:

Large	—	2½ in. to 2¾ in. long. 1½ in. thick. 64 nuts per kilo (25 per lb.). 30 nuts per litre weighing 490 gms. Each nut about 16 gms. (just over ½ oz.).
Medium	—	1¾ in. to 2¼ in. long. 38 nuts per litre.
Small	—	1¼ in. to 1¾ in. long. 64 nuts per litre.

Regarding the quantities of each grade that are produced, typical figures of exports from the port of Belem comprised 6 per cent. large, 54 per cent. medium, and 40 per cent. small.

Nuts for export should be fresh, that is to say on cutting the kernels should present a milky appearance. Cut samples containing over 90 per cent. of milky nuts are judged to be superior, over 85 per cent. as medium, and less than 80 per cent. as inferior. The practice of mixing old nuts with fresh ones is strongly condemned.

Among the producing districts, nuts from Paru and Jary have a reputation for quality and are said to command the highest prices. Whether this superior quality of the produce of these districts is due to more careful washing and preparation of the nuts after harvest, or to any intrinsic varietal superiority it is difficult to say.

The bulk of the crop is exported in the shell, but as will be seen from the figures given on page 351 there is also an appreciable trade in shelled nuts, the greater part of which is taken by the United States. Machines are available by means of which the nut can be removed whole from the shell.

Brazil nuts are liable to be adulterated with other forest nuts, more especially with nuts of *Lecythis* spp., commonly called monkey pot trees. The presence of such adulterants is considered to be undesirable unless the nuts are to be used locally for oil extraction, and regulations to prevent such adulteration have been in force for some years.

Establishment of Plantations

Very little progress appears to have been made so far in the direction of the establishment of plantations in Brazil. It is advised that only fresh seed should be used, as dry nuts germinate but slowly. In Brazil the best time to sow is stated to be at the height of the cropping season, i.e. from January to March; the nuts germinate in two to three months. The young seedlings may be kept in nursery beds for a year when they will be just over 2 ft. in height; they are planted out in the field at a spacing of from 35 to 40 ft. apart. No special attention seems to be given to transplanting and early cultivation, no shade is employed and manuring is not normally practised. At five years the trees will have attained a height of from 13 to 20 ft., and may be some 80 ft. high when twenty-

five years old. The first flowers may appear when the trees are four years old, and some fruits may be borne the following year, though fruits are not usually produced from the first two or three seasons' flowers. An appreciable crop should be produced when the plantation is about twelve years old.

Composition and Uses

The edible portion of the Brazil nut comprises a little over half of the weight of the nut as purchased in the shell, the percentage of kernel usually ranging from 51 to 53 per cent. It is somewhat richer in oil than most other dessert nuts but rather poorer in proteins. The following comparative analyses are taken from Plimmer's *Analyses and Energy Values of Foods* [9].

	Brazil nuts.	Jordan almonds.	Hazel nuts.	Walnuts.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Water . .	2·9	4·2	3·7	3·0
Ash . .	3·3	3·2	2·7	2·3
Fibre . .	2·1	2·9	2·9	1·3
Protein . .	13·2	22·0	13·2	20·7
Carbohydrate (by difference)	8·1	15·5	14·3	13·8
Fat . . .	70·4	52·2	63·2	58·9

The vitamin content of the nuts is not outstanding. Those whose presence have been recorded are A, B (complex) and C.

The digestibility of the nuts has been investigated by Jaffa [10] and that of the oil by Holmes [11]. The latter states: "The high digestibility of Brazil nut oil and the relatively high digestibility of Brazil nuts as a whole, as reported by Jaffa, would indicate that from a dietetic standpoint these nuts are worthy the high place accorded them as food."

The chief use of Brazil nuts is for dessert purposes, for which unshelled nuts of large size are in demand. In Brazil the large nuts are generally regarded as being those of the highest quality, but this may partly be due to the fact that these receive more careful attention during preparation.

Brazil nuts are also largely employed for confectionery purposes and when used whole, as for example as centres for chocolates, the manufacturer prefers a relatively small nut. Such a requirement would have to be kept in mind when considering any development of a plantation industry.

Brazil nut oil is a liquid, semi-drying oil, resembling

cotton-seed and sesame oils in its general characteristics. The oil, which possesses to some degree the flavour of the nuts, is eminently suitable for edible purposes, but in normal circumstances the value of the nuts is too high for economical extraction. In Brazil small quantities of the oil are expressed and used for lighting and cooking. The following constants of the oil have been recorded: specific gravity at 15·5° C., 0·9166-0·921; refractive index at 25° C., 1·4643-1·4681; saponification value, 192-202; iodine value, 95-107; solidifying point of fatty acids, 31-33° C. A complete examination of the oil has been made by Schuette and others [12, 13], whilst Georgi [14] has recorded the results of examination of the oil extracted from Malayan grown nuts.

The Brazil nut tree is also valued for its hard and durable timber. The exploitation of the timber does not appear to be regarded with favour, however, on account of the fear of a permanent reduction of the nut crop; nevertheless it is said that trees tend to disappear in some of the more accessible localities as a result of cutting for timber.

Prospect of Production in Empire Countries

The only part of the Empire in which the Brazil nut is indigenous appears to be British Guiana, where it is stated to be plentiful in the Upper Essequibo and Rupununi districts. Schomburgk [15] says that the tree stretches along the plains between Long. 57° and 68° W. and between Lat. 6° S. and 4° N., which would include the whole of the southern part of the country up to the Makarapan Mountains. It seems, however, to be most plentiful in the parts bordering Brazil. Schomburgk states that the tree seems to prefer a stony soil and to be seldom present at altitudes above 1,500 ft. or below 400 ft. The nuts are collected for local use, but transport difficulties from such remote districts under existing conditions are against their commercial exploitation. Few attempts have been made to cultivate the tree in British Guiana. It was planted at the Government Industrial School at Onderneeming in 1902, but growth was slow, and it appears that if any efforts are made in the Colony to grow a nut crop it is more likely that attention will be devoted to the Souari nut (*Caryocar nuciferum*), which has been grown successfully at Onderneeming and fruited at a reasonably early age.

The Brazil nut has been introduced into many tropical parts of the Empire, including Malaya, Ceylon, North Borneo, some of the West Indian Islands, Seychelles, and quite recently into Nigeria and the Gold Coast, but nowhere has production reached a commercial stage.

The most promising results so far achieved have been obtained in Malaya, where the Brazil nut was first introduced about 1884. Considerable attention has been given to the tree by the local Agricultural Department, and the information available up to 1930 is published in a bulletin of the Department [16].

A small plot of Brazil nuts was established in 1914 at Kuala Lumpur, and yields are available for the years 1925 to 1929. While one or two trees have given satisfactory yields, the returns for the plot as a whole are not encouraging, and the fact that ten years elapsed before yields commenced is considered to be a serious adverse factor as far as commercial plantations are concerned. Trade reports on samples of Malayan nuts sent to the United Kingdom were reasonably favourable.

In Malaya germination of the seed has been found to be both slow and uncertain, and in raising seedlings the use of bamboo joints is advocated to minimise losses in transplanting. An attempt at vegetative reproduction by ring wiring and earthing up shoots arising from pegged down seedlings was unsuccessful. Further experimental plantings have been made, and seedlings have been distributed to the public, but so far there seems little prospect of commercial plantations. Lambourne considers that the tree might be planted on a small scale around private dwellings in order to produce nuts for home consumption and that any surplus would find a ready market locally at satisfactory prices.

As regards other Empire countries, the Brazil nut has been successfully established at Peradeniya and at Heneratgoda, Ceylon, since about 1880, and is reported to have borne a good crop at Peradeniya ; no more extensive cultivation seems to have been attempted. Early introductions into North Borneo appear to have failed, but the Brazil nut was reintroduced to that Territory in 1931 and again in 1935 and now appears to be succeeding. The introduction to the Seychelles is comparatively recent, but the tree appears to thrive there and has

been distributed to the public among economic plants issued from the departmental nurseries. In Jamaica the tree is established at the Botanic Gardens and in 1921 a single mature specimen was said to be growing well in the Botanic Gardens at St. Vincent. The tree is known in Trinidad and fruits well at the Botanic Gardens, and also at the Government Farm, St. Joseph. The tree is recorded as growing in 1918 at the Botanic Station, Belize, British Honduras.

References

1. Petch, T. " Notes on the Brazil Nut Tree in Ceylon." *Ann. Roy. Bot. Grdns. Peradeniya*, Vol. 5, Pt. 6, 1913, pp. 421-431.
2. Deshmukh, G. B. " The Brazil-Nut Tree in Singapore." *Str. Settlem. Grdns. Bull.*, Vol. 2, No. 12, 1921, pp. 435-438.
3. Sands, W. N. " Botanical Notes on the Brazil Nut Tree in Malaya." *Malay. Agric. J.*, Vol. 10, No. 5, 1922, pp. 130-132.
4. Sands, W. N. " Further Notes on the Brazil Nut Tree in Malaya." *Ibid.*, Vol. 14, No. 5, 1926, pp. 125-127.
5. " Brazil Nuts." *Ibid.*, Vol. 11, No. 2, 1923, pp. 41-43.
6. Pierrot, A. O. " Brazil Nut or Castanha Industry." *Tr. Inform. Bull.* No. 259 (1924), *U.S. Bur. Comm.*
7. " A Exploracao da Castanha do Para." *Monograph, Minist. Agric., Rio de Janeiro*, 1929.
8. Freise, F. W. " Die Paranuss (Brasilnuss)." *Tropenpflanzer*, Vol. 36, 1933, pp. 13-19.
9. Plimmer, R. H. A. " Analyses and Energy Values of Foods." London, 1921.
10. Jaffa, M. E. " Further Investigations among Fruitarians at the California Agricultural Experiment Station, 1901-1902." *Bull.* 132 (1903), *Off. Exp. Sta., U.S. Dep. Agric.*
11. Holmes, A. D. " Studies on the Digestibility of some Nut Oils." *Bull.* 630 (1918), *U.S. Dep. Agric.*
12. Shuette, H. A., and others. " Brazil Nut Oil." *J. Amer. Chem. Soc.*, Vol. 52, 1930, p. 4114.
13. Shuette, H. A., and Enz, W. W. F. " Composition of Brazil Nut Oil." *Ibid.*, Vol. 53, 1931, p. 2756.
14. Georgi, C. D. V. " Some Malayan Vegetable Oils and Fats of Minor Importance." *Malay. Agric. J.*, Vol. 10, No. 9, 1922, pp. 222-223.
15. Schomburgk, R. " Travels in British Guiana," Leipzig, 1848. (English translation, Georgetown, 1923.)
16. Lambourne, J. " The Brazil Nut in Malaya." *Bull. Dep. Agric. S.S. and F.M.S., Gen. Ser.*, No. 2, 1930.

THE PREPARATION OF CITRUS FRUIT JUICES

The following statement has been prepared in response to specific inquiries received at the Imperial Institute and may be of interest to others in the Empire who are considering starting an industry in these products. The Institute will be pleased to furnish inquirers with further particulars regarding details of the processes and the names of firms which supply the necessary equipment.

Citrus fruit juices come on to the market in various forms, as (*a*) cordials, (*b*) squashes, (*c*) pure fruit juices, with or without fruit cells, (*d*) juices for special purposes, such as concentrates for use in the milk bar trade, etc.

Cordials are clear beverages consisting of fruit juice to which has been added syrup, usually together with small quantities of flavouring and colouring materials. Squashes differ from cordials in that they are cloudy, due to the presence of fruit cells and suspended matter in the juice used in their preparation. The proportion of fruit juice in these beverages varies somewhat according to the particular brand, but it may be regarded usually as forming from about a third to a half of the whole. Both cordials and squashes are also prepared in an aerated or carbonated form.

Early in the development of the citrus fruit juice industry all citrus juices were rendered clear, but the trend to-day, with the exception of lime juice, is towards a cloudy or pulpy juice.

During recent years a great deal of work has been done, particularly in the United States, in devising methods of preserving citrus juices in their natural state without the addition of preservatives or other materials. In America large quantities of citrus juices are consumed in this form, but so far as the United Kingdom is concerned cordials and squashes are still the popular types of beverages.

The juices of the different citrus fruits vary in keeping properties and the methods of manufacture vary somewhat accordingly.

Lime juice manufacture, for instance, presents comparatively little difficulty. The whole fruit is crushed between rollers which express the juice together with the essential oil from the peel. The oil is then separated by centrifuging. The juice is

allowed to settle and the clear liquid drawn off, preservative in the form of sodium or potassium metabisulphite added and the juice packed in casks.

The extraction of the juice from the other important citrus fruits such as orange, lemon and grapefruit is carried out briefy in the following manner: in the most commonly used method the whole fruit after washing is cut in half at right angles to the axis of growth and the juice extracted by pressing the halved fruit against a revolving conical ribbed or grooved extractor or burrer. By adjusting the speed of the burrer, it can be so arranged that the inclusion in the juice of any considerable amount of "rag" or pith and essential oil from the peel can be avoided. The large pieces of fruit particles and seeds are then removed by screening, leaving behind only the finer fruit cells. When required for the manufacture of squash the juice is shipped in this form in casks with the addition of preservative.

According to the Food and Drugs Act sulphur dioxide and benzoic acid are the only preservatives permitted in non-alcoholic beverages sold in the United Kingdom. The product when retailed to the consumer must not contain more than 350 parts per million of sulphur dioxide or 600 parts per million of benzoic acid. The preservative is usually added in the form of solutions of sodium or potassium bisulphite and sodium benzoate respectively. The equivalent amounts of these three compounds are approximately 570 parts per million of sodium bisulphite, 650 parts per million of potassium bisulphite and 710 parts per million of sodium benzoate.

Benzoic acid often imparts an unpleasant "burning" taste to fruit juices and the use of sulphur dioxide preservatives is generally preferred. Raw fruit juices when imported into the United Kingdom normally contain approximately the following amounts of sulphur dioxide per million:

Lemon and lime juice . .	350 parts
Grapefruit juice	650-750 parts
Orange juice	750-850 parts

As the juices are usually diluted two to three times in making up beverages, the content of sulphur dioxide in the final product is well below the permissible amount. Further preservative is then often added to bring the content up to 350 parts per million.

In the case of orange juice a certain amount is prepared in the concentrated form in order to save bulk in shipment. For this purpose the juice is roughly filtered before concentration and concentration is carried out under reduced pressure in special plant.

As already mentioned, the demand in the United Kingdom is for cloudy citrus fruit juices. The removal of suspended matter, though in some cases improving appearance often detracts considerably from the colour, flavour and nutritive value of the expressed juice. The colour and flavour of orange juice depends to a large extent on the suspended particulars which it contains and the removal of these gives a straw-yellow product lacking aroma and flavour. Orange juice is therefore now seldom prepared in the clear form.

The efforts in the United States to market citrus juices in a form closely resembling the natural juice has involved additional stages in their preparation. The modern method of manufacturing citrus juices which is carried out extensively in the United States proceeds along the following general lines. After the screening of the juice to eliminate the seeds and coarse pulp, it is subjected to a process of de-aeration, i.e. the removal of the occluded air in the juice by means of vacuum treatment. It has been found that the presence of air in the juice markedly effects the flavour after storage, particularly if the juice has to be submitted to heat treatment. De-aeration is accomplished by passing the juice in the form of a fine spray into an evacuated tank. This removes any air which has been occluded in the juice and in the fruit particles. After the tank is partly filled the juice is held under a vacuum of at least 27 in. for about 10 minutes. The vacuum may then be relieved, preferably with an inert gas such as nitrogen.

Immediately after de-aeration the juice is passed to a flash pasteuriser. Usually the de-aerating unit is connected with the pasteurising unit so that the juice does not come in contact with air until it issues hot from the pasteuriser. Flash pasteurisation consists of subjecting the juice to a high temperature, in the neighbourhood of 200° F., for a very short period, sometimes only a few seconds. In ordinary pasteurisation, of course, the juice is heated at a lower temperature for some time. After flash pasteurisation the juice is packed either in cans or

bottles under vacuum. Grapefruit juice has better keeping properties than either orange or lemon.

If a clear juice is required the method most generally applicable depends on the fact that by heating the juice the colloidal matter is coagulated and will then settle out readily and can be removed by filtration. The de-aerated juice is passed through a flash pasteuriser and held at about 180° F. for about a minute, cooled rapidly, a quantity of filter aid, such as kieselguhr, added, and the whole passed through a filter press. Such a process gives a fairly good product, but as already pointed out it is inferior to the juice in which the fruit cells are allowed to remain. Another method used for preparing clear juices is clarification by the gelatin-tannin process.

The following account of the gelatin-tannin process is given in *Circ.* 344, *Agricultural Experiment Station, California*:

"The bulk of the suspended matter, particularly in apple juice, consists of protein and pectin-like substances. These colloidal substances carry an electrical charge, generally negative, and are precipitated when this charge is reduced to zero by the addition of a colloid bearing an electric charge opposite in sign to that of the colloid to be removed. Gelatin and casein act in part in this manner and in part by forming insoluble precipitates with the constituents of the juice (casein with acid, gelatin with tannin) which on settling carry with them other suspended particles.

"The gelatin-tannin process is the most widely used colloid-precipitation process for clearing fruit juices, but since the chemical reaction involved must be accurately adjusted for each juice and each type of gelatin used, considerable time and experience are necessary in making the required tests. Laboratory tests are first conducted to determine the correct amount of gelatin to add for the juice to be treated. Since there is danger of clouding the juice by the use of too much gelatin, tannin is usually added so that no excess of gelatin remains. The addition of tannin to the juice also helps to minimise the bleaching of the colour that occurs during a gelatin-tannin clarification, since the added tannin helps to replace the natural tannins of the juice removed during clarification. In commercial practice about 1·25 oz. of tannin and from 1·5 to 6·0 oz. of gelatin, according to the condition of the juice, are required per 100 galls. The tannin is added

first to the juice, the juice being well stirred, next the gelatin solution, the juice being agitated during and for several minutes after the addition of the gelatin solution. After this the treated juice is allowed to stand undisturbed for 18 to 24 hours for the precipitated matter to clot together and settle out. The clarified juice is then siphoned off the sediment, care being taken not to disturb the latter."

Another widely used process of clarification, particularly for apple juice, is by the use of pectin-destroying enzymes. These transform pectin into insoluble pectic acid which on precipitation carries down other suspended matter. There are various enzyme preparations on the market, and the manufacturer's directions should be closely followed if the best results are to be obtained. The amount to be used will depend on the type and activity of the enzyme, the amount of suspended matter in the juice, the composition, particularly the acidity, of the juice and the temperature and time of storage. After clarification by enzymes the juice must be heated to 150° F. to prevent any further enzyme action.

As citrus juices contain considerably less colloidal and pectinous material than apple or grape juice for instance, methods of clarification such as those mentioned above are sometimes omitted, and the clear juice prepared simply by centrifuging to remove the bulk of solid material, and then filtered through pulp filter after the addition of a filter aid.

In the older methods the extracted juice was allowed to defecate, that is it was allowed to stand until the solid matter settled out in a layer at the bottom of the container. Preservative such as potassium metabisulphite was added to prevent fermentation during the process. After the juice had defecated a sufficient length of time it was passed through a pulp filter, filter aids being sometimes used. The clear juice was then pasteurised in bottles or casks. Although with citrus juices prepared by this method there is very little settling out on storage, the quality and appearance bears no comparison with juices prepared by up-to-date methods.

The type of juice to be manufactured will depend entirely on the market to be supplied. If a fastidious taste is to be met and one which demands a juice closely approximating to the fresh natural product then every precaution must be introduced into the method, resulting in higher costs of plant and

manufacture. If, however, a fruit juice cordial, making no pretence at approaching the nature of the fresh juice, is required then extraction, followed by filtering and addition of syrup, flavouring and colouring materials, and preservatives will probably suffice.

Literature.—Further details of the methods of fruit juice extraction, preservation and the manufacture of beverages are given in the following publications:

Commercial Fruit and Vegetable Products. By W. V. Cruess. 1938. Obtainable from the McGraw-Hill Publishing Co., Ltd., Aldwych, London, W.C.2, price 36*s.*

Fruit and Vegetable Juices. By D. K. Tressler, M. A. Joslyn and G. L. Marsh. 1939. Obtainable from the Avi Publishing Co. Inc., 31 Union Square, New York, price $6.15 post free.

"Utilisation of Fruit in Commercial Production of Fruit Juices." By M. A. Joslyn and G. L. Marsh. *Circular* 344 (1937), *California Agricultural Experiment Station.* Obtainable from the University of California, Berkeley, California, U.S.A., price not stated. An excellent account of modern practice.

"The Preservation of Citrus Fruit Juices." By H. A. Tempany. *Bulletin of the Imperial Institute*, 1938, **36,** No. 3, 334-349.

"Retaining Flavour and Vitamin Content in Fruit Juices." By M. A. Joslyn. *Fruit Products Journal*, 1937, **16,** No. 8, 234-336.

"Some Observations on the Preparation and Preservation of Citrus Fruit Squashes." By Lal Singh and Girdhari Lal. *Indian Journal of Agricultural Science*, 1938, **8,** Pt. 1, 77-91. Obtainable from the Manager of Publications, Delhi, price 5*s.* 3*d.*

Beverage Manufacture (Non-Alcoholic). By R. H. Morgan. 1938. Obtainable from Attwood & Co., Ltd., St. Ann's Chambers, Waithman Street, London, E.C.4, price 30*s.* This book does not deal with the actual extraction of the juice, but with its use in beverage manufacture.

"Citrus Products," Parts I and II. By J. B. McNair. Issued as *Publication* No. 238 (1926) and *Publication* No. 245 (1927), *Chicago Field Museum of Natural History.* Obtainable from the Museum, price not stated. Although dealing with the older methods, these volumes contain much useful general information.

NOTES

The Cultivation and Distillation of Lemon Grass in Travancore.—The following information is taken from a report submitted to Messrs. Peirce, Leslie and Co., Ltd., by Mr. I. W. Campbell, a member of their staff at Cochin, a copy of which has kindly been furnished to the Imperial Institute by the firm.

The cultivation of lemon grass in India is now restricted to remote country districts in the northern portion of the Travancore State, where the elevation ranges from sea level to about 500 ft. There used to be a little cultivation in Central and South Travancore, but this has now ceased entirely and no supplies of oil have been received from these districts for some years. Cochin is the port of shipment and in respect both of total exports and market importance, what is known as Cochin Lemon Grass Oil easily heads the list as compared with the produce of other countries.

The chief marketing towns which form more or less the hub of their respective districts are, in order of importance, Kothamangalam, Always, Muvattupuzha, Thodupuzha and Ferumbavoor.

Lemon grass is a hardy plant and will grow in almost any kind of soil from rich loam to laterite. The type of soil does, however, affect the oil content of the grass. The more fertile the soil the lower the citral content, although the yield is high. In laterite soil the citral content is high, but the yield is naturally less. Kothamangalam and Always districts are the two best respective examples of this.

Even in areas where the grass receives some attention the growth is very scattered. Patches of land here and there may be quite bare and elsewhere there will be a prolific growth.

The root is perennial and an area once planted will continue bearing for some years with little or no attention. The life varies from six years in some districts to fifteen years in others, but the majority of reports indicate that 8-10 years is the normal productive life of the grass, the most productive period being from the second till the sixth year of growth.

When ready for cutting the grass is about 4 ft. high. The part which contains the oil is the round stalk at the foot of each blade in the heart of the clump. This portion varies in length from 6 in. to 1 ft.

It is found that it is bad to cut during or soon after rain. The oil mounts highest during dry weather and it is then therefore that the best results are obtained. A continuously wet season therefore would considerably affect the yield of oil.

Sowing commences as soon as there has been sufficient rain to moisten the soil well. The ground, which only requires to be cleared of scrub and roughly ploughed, is usually prepared in advance during the dry weather. Normally, the first showers are about the second half of March and this can be taken as the sowing period. Although the actual time of sowing may differ each year according to weather conditions, the variation is not great.

Provided weather conditions continue normal, neither too much nor too little rain and plenty of sunshine, the young grass will be ready for cutting after about six or seven weeks. Areas which are already in grass will be ready for cutting much sooner. The harvesting season may be taken therefore as May/December. There are normally only four cuttings during this period, about six or seven weeks apart. First cutting, May/June; second cutting, July/August; third cutting, September/October; and fourth cutting, November/December. The second and third cuttings usually yield more oil than the other cuttings. In a fertile district such as Kothamangalam it is possible, given favourable weather conditions, to get five cuttings, provided also that the price is sufficiently attractive to induce cultivators to take another cutting.

Cultivation is very unorganised and haphazard, and owing to the producing areas being so scattered and in such wild country it is very difficult to estimate the acreage under cultivation, and practically impossible to gauge the potential crop growing thereon.

The places where lemon grass is found growing are some distance further inland from the marketing centres already mentioned. In the rural districts, which are the main producing areas at the present time, firewood is abundant, cheap and often free in the neighbouring forests, whilst the ground also conserves the moisture better. Therefore the grass comes on more quickly at the beginning of the season. In the urban areas around the towns the cost of production is, just now, prohibitive on account of the scarcity of firewood and therefore its expense. Also, water is not so readily available. Consequently, cultivation in the urban areas has been given up in favour of ginger, pepper and turmeric, which have been much more remunerative crops up till now.

After cutting, the grass is taken for distilling. This operation is very simple and the methods used are extremely primitive. Mr. Campbell quotes a description of the process taken from a report by Mr. Ramaswamy Iyer, of which the following is the substance.

A big factory with up-to-date modern equipment and elaborate machinery is not necessary for the extraction of lemon grass oil. The scene of operations is a small thatched

shed measuring 20 ft. × 16 ft. At one end of the shed a big cylindrical vessel about 5 ft. high and about 12 ft. in circumference rests on a rude country hearth. Thence a pipe projects horizontally, discharging into a coiled pipe fitted into a tub containing cold water. At the outlet of the coiled pipe, another small vessel is placed to receive the contents discharged. At one side of the big vessel there is a manhole into which small bundles of grass are deposited. For one distillation about 250 to 300 bundles are put into the vessel, together with sufficient water, and the opening is then firmly closed. The hearth is then made ablaze and gradually the process of distillation commences. The oil passes off as vapour, becomes condensed in its passage through the pipe and gets discharged into the small vessel. It is necessary that the tub should be frequently filled with cold water in order to effect condensation. The discharged matter in the small vessel will be a mixture of lemon grass oil at the top and a good quantity of water at the bottom. A syphon tube arrangement fixed to the collecting vessel facilitates the discharge of the watery matter, leaving the oil behind.

The following particulars of shipments of lemon grass oil from Cochin during the period 1925/38 have been kindly supplied by Messrs. Peirce, Leslie and Co.:

1925 . .	216 tons	1932 . .	170 tons
1926 . .	267 ,,	1933 . .	177 ,,
1927 . .	258 ,,	1934 . .	302 ,,
1928 . .	351 ,,	1935 . .	353 ,,
1929 . .	315 ,,	1936 . .	331 ,,
1930 . .	175 ,,	1937 . .	356 ,,
1931 . .	198 ,,	1938 . .	379 ,,

The heavy falling off in shipments during the period 1930/33 was due to the slump and low prices then prevailing for lemon grass oil. This was followed by the inevitable reaction in the shape of a steep rise in price during 1934, resulting in a big programme of new planting during 1934 and 1935 and that in turn brought about a collapse of the market in 1936, since when the market has been on an abnormally low level. Thus, the price in 1934 rose to as much as 4*s*. 6*d*. per lb. c.i.f. London, and since 1936 the highest and lowest prices touched have been 2*s*. 3*d*. and 1*s*. 3½*d*. respectively; during the greater part of the period 1936 to date the price has ruled below 1*s*. 6*d*. and at the end of August 1939 business was done at 1*s*. 4½*d*. c.i.f.

RECENT RESEARCH ON EMPIRE PRODUCTS

A Record of Work conducted by Government Technical Departments Overseas

AGRICULTURE

SOILS AND MANURES

Montserrat.—Mr. W. E. Bassett, Curator of the Agricultural Department, states in his report for the half-year ending June 30, 1939, that the observational experiment laid down in connection with soil erosion control (see this BULLETIN, 1939, **37**, 37) has been planted with cotton, sugar-cane, sweet potatoes and ground-nuts. Rainfall has been comparatively light since the experiment was laid down and very little erosion caused by the movement of water has been observed. There are indications that a serious factor in the soil erosion problem in Montserrat is the practice of always pulling the soil downhill when cultivating it by means of hoes. During the recent very dry, windy weather some movement of soil by wind has been observed in cotton fields.

Nigeria.—Mr. K. Hartley, Agricultural Chemist, Southern Provinces, in his report for the half-year January-June 1939, states that the first series of crop yields from comprehensive artificial manuring experiments which have been started as permanent experiments on several of the Agricultural Department's farms in the Southern Provinces indicates considerable differences in reaction to manures. It has previously been found that in the Northern Provinces applications of inorganic nitrogen have little effect. The same result is found at Ibadan on a soil of similar (igneous) origin, but on the acid soils derived from sedimentary rocks the importance of nitrogen is considerable.

Mr. W. A. Watson, Agricultural Chemist, Northern Provinces, in his report for the same period, states that the permanent manurial experiment laid down in 1937, and commented on in an earlier report (see this BULLETIN, 1938, **36**, 222) has been continued. The cropping last year was with sweet potatoes. The yields of tubers showed no significant increase for the N.P.K. treatments over the control of farmyard manure at the rate of 2 tons per acre. The sweet potato tops gave for the treatment N.P.K. (equivalent to the amount in 2 tons of farmyard manure) a significant increase over the farmyard manure.

INSECT PESTS

Nigeria.—The following report by Mr. F. D. Golding, Senior Entomologist, on the work of the Entomological Section of the Agricultural Department during the period January to June 1939, has been received.

Locust Research.—The Kalkala area near Lake Chad was examined in early February. The inundations of late 1938 were very extensive and comparable to those of late 1936. Eight collectors spent four days examining the various habitats along the Lake shore and for four miles inland along the River Yedseram. Only three specimens of *Nomadacris* were found, but 48 *Locusta* [*ph. solitaria* and *transiens* (*dissocians*)] and nearly 300 grasshoppers of various species were collected. During the 1937 patrol only two *Locusta* were taken, while in the 1938 patrol no *Locusta* were seen, and grasshoppers were rare; it is evident that conditions must have been very favourable for Acrididae during the rains of 1938.

Mosquito Research.—A mosquito survey of Moor Plantation, the headquarters of the Agricultural Department near Ibadan, was made early in the year. For several years it had been noticed that mosquitoes were more numerous on the northern part of the residential area during the dry season than in the rains. Examination of adult mosquitos caught in a house showed that about two-thirds of them were *Mansonia africana*, the larvæ of which are associated with the water lettuce (*Pistia stratiotes*). In the autumn the local river ceases to flow over a dam, and much of its surface—for a distance of about half-mile upstream—becomes covered with *Pistia*. This section of the river lies to the north-east of the houses, and the adult mosquitos are carried to houses as much as 700 yds. from the river during periods when the "harmattan" wind is blowing. The bulk of the *Pistia* was removed, and several other important breeding areas were dealt with; these measures were responsible for a very marked decrease in the number of mosquitos in habitations.

Fruit-piercing Moths.—From February to the end of June, whenever time was available, a search was made for the larvæ of fruit-piercing moths in the bush surrounding Moor Plantation. Not a single larva of *Achaea* spp. was found, and only one of *Othreis* (*divitiosa*) was obtained. In late March, two assistants spent two days in the forest reserve at Olokemeji, about 22 miles west of Moor Plantation, and obtained three batches of *Achaea* larvæ. None of the larvæ was parasitised.

During the mid-crop season of 1938 the bulk of the considerable damage to the Citrus crop was caused by *Achaea* spp., which first appeared at the beginning of April. In the present year *Achaea* was very rare at Ibadan, and there was

practically no damage done until early May. The losses were considerably less than those of 1938 and were almost entirely due to *Othreis* (principally *fullonia*), of which only 12 specimens were seen in the previous year. Bait traps of the Gunn type and poisoned mangoes were put out in the orchards, but nocturnal observations showed that they were ineffective against *Othreis*. The number of moths present was not very great and, in small orchards, hand-picking should give beneficial results ; *Othreis* is lethargic when feeding and seems to prefer to feed on fruit low down on the tree (at any rate, when the food supply available is considerable).

Insecticides

Derris

Malaya.—Mr. T. A. Buckley, Acting Senior Chemist, in a statement on the work conducted during the half-year January-June 1939, reports that four clones of *Derris elliptica* Changi 3 have been finally selected for multiplication on the basis of high toxic content and high yield. The average rotenone content was 12·25 per cent. on moisture-free basis, and the average yield 15·5 oz. per plant of air dry root (moisture 8 per cent.). The yield of root appears to depend on several factors, including environment, spacing and size of cutting. These factors are being studied.

Beverages

Cacao

Gold Coast.—The following statement relating to research work conducted by officers of the Agricultural Department during the half-year January-June 1939, has been furnished by the Acting Director of Agriculture.

Botanical.—Pollination experiments have been conducted with six trees enclosed in cages of cloth of three different meshes. A fine mesh is intended to keep out all insects, muslin to allow thrips only to pass, and wide mesh mosquito netting to keep out insects larger than Micro-lepidoptera. All non-flying insects are excluded by coating the base of the cage and of the tree with sticky material. These caged trees together with ten sticky-banded trees, whose flowers can be reached only by flying insects, are being recorded daily as regards flowering and setting. All trees were proved self-compatible before caging or banding.

The daily flower setting and leaf flush counts showed that when setting on the control trees reached 100 per cent. heavy flowering had occurred in the cages without a single set, thus proving the necessity for insect intervention.

All caged trees flushed heavily in February, although no other trees in the plot flushed at all, an effect thought to be due to the elimination of *Sahlbergella* in the caged trees.

Setting was eventually recorded in one baft (fine mesh) cage and one mosquito net cage, and a list of insects present after setting has been recorded.

In an experiment to determine the exact time of day at which pollination is effected a new method of controlling pollination is being tried—the use of uncut specimen tubes to protect the flowers, instead of the usual muslin covered tubes. Using 10 flowers, one " set " was recorded in a 7 a.m. to 12 noon exposure, four " sets " in a 12 to 5 p.m. exposure, and none in a 5 p.m. to 7 a.m. exposure. The greater afternoon setting was, however, not significant. Emasculated flowers showed that natural cross-pollination can take place in June; 11 sets were obtained from 45 emasculated flowers.

Pod statistics (wet weight of beans and number of beans) were taken from over 800 Amelonado trees, 10 pods per tree being taken as a sample. The data plotted as curves for bean weight and number of beans per pod, indicated an homogenous population, contrasting with corresponding data obtained from the " Trinitario complex," tending to confirm the belief that West African Amelonado is a pure species, within which opportunity for selection is small.

The 30 trees which gave the highest mean weight per pod in a survey carried out in the previous July had all their pods weighed in the January picking, when it was found that none continued to show a mean wet weight much above the mode of the population, tending to show that genetic variation in pod size is so small that it is usually swamped by variation due to external factors (mainly climatic). Bean number is less variable than mean wet weight per pod.

Buddings have been made on farm seedlings to supply material for further budding on clonal rootstocks, and further cutting material.

A farm survey to determine the proportion of hybrid trees on native farms indicated that a considerable number exists in certain areas. It is thought that the greater variation in these hybrid trees will provide opportunity for selection for yield and quality. Compatibility tests have been made on provisional selections in hybrid cacao.

In October 1938 six buddings were made by the Botanist at Tafo Station, using " swollen shoots " for bud material, on farm seedlings. Only two of the " swollen " buds took, one of which died later, the stock also dying. The remaining " swollen " bud took satisfactorily, but has not yet sprouted. Above the bud union stock buds sent out shoots which show swellings and chlorosis.

Plant Pathology Investigations.—Two rooted cacao cuttings have been planted on farms affected by "swollen shoot" and observations on these will be maintained. The effect on the spread of die-back of the planting of quick-growing shade (plantains) is being observed at Tafo Station. Two root diseases of cacao at Tafo Station (brown root disease—caused by *Fomes noxius*, and white root disease—caused by *Rigidiporus microcarpus*=*Fomes lignosus*) have been investigated, and experiments towards their control by trenching and planting up of quick growing shrubs were begun.

Entomological.—From random collections on a one-quarter acre plot severely attacked by *Sahlbergella* spp. figures of weekly totals of *Sahlbergella* spp. and of No. 1239 (? *Bryocaropsis* sp.) were obtained. The total incidence of each species reached its peak in May, and since then has been gradually falling off. Preliminary cage records of the life history of No. 1239 gave the following data:

Egg Incubation period.	Nymphal period.	Cycle oviposition to adult.
13·5 days	19·5 days	33 days

Observation on Tafo Station showed that *Sahlbergella* spp. and No. 1239 are preyed on by a predaceous bug (closely allied to *Harpactor* sp., family Reduviidæ) and by the red tree ant (*Oecophylla smagdarina longinodis*). The latter has been recorded before as keeping trees free from *Sahlbergella* under certain conditions. No. 1239 attacks much younger pods than is usually the case with *Sahlbergella*, and attack appears to be mainly confined to pods.

Over 65 per cent. of the total number of pods harvested at Tafo Station were attacked by *Sahlbergella*. Very severe damage, resulting in death of trees, was recorded on a plot of young trees. In 14 days of hand picking 169 bugs were removed from 75 trees.

Tea

Malaya.—The report of Mr. T. D. Marsh, Acting Senior Agriculturist, for the half-year January-June 1939, contains the following statement regarding experimental work carried out on tea.

(1) The question of starch reserves in the roots of lowland tea is under investigation in collaboration with the Senior Chemist. Preliminary research indicates that such roots do contain starch, whilst the bushes are under routine plucking.

Associated with this subject is the question of the minimum period of rest from plucking the bushes required to accumulate sufficient starch to withstand the shock of pruning without heavy mortality among the bushes. The normal routine of

resting the bushes for three months before pruning causes a loss of crop for this period, and a controlled experiment has been designed to ascertain the extent by which this period can be reduced without affecting adversely subsequent yields. Resting for two months, one month, also no rest before pruning, are being compared with the normal three months' rest.

(2) An experiment has been laid down to test the effect throughout the year on yields and quality of made tea from shaded and unshaded areas.

(3) Comparative germination tests have been made of tea seed following the two methods of shelling as hereunder :

(*a*) Dry shelling of the fruit capsules ;

(*b*) Soaking of the capsules for 4 days in wet sand to facilitate shelling.

The results indicate that soaking does not activate the enzyme of germination, while no deleterious effects on the seed were occasioned by soaking the capsules followed by storage for two weeks before the germination trials were commenced.

Cereals

Rice

Malaya.—The report of Mr. R. B. Jagoe, Botanist, for the half-year January-June 1939, contains the following statement on rice.

(1) One of the more important sides of recent research work on rice is experiments in the determination of optimum seasons in different areas :

The relevant factors are :

(i) Water supply and control.

(ii) Date of sowing.

(iii) Breeding phases of stem-borers.

With regard to these three factors the Botanist, empirically, and the Senior Entomologist, by particular experiment, have independently come to the conclusion that, with reasonable water supply, June is the most suitable month for sowing padi seed in several parts of the country.

(iv) Maturation periods.

Maturation period varied according to the variety, long medium or short terms, and according to planting methods, but it is apparently also affected by small differences in latitude (length of daylight) and trials for examination of this have been laid down.

(2) The effects of planting distances on numbers of tillers, weight of ear and total weight of grain in different conditions

or fertilities of soil are being studied, and the inter-relationship of these factors in selection methods with wide-spaced selection lines, and closer planted field trials.

(3) The food value of under-milled rice is recognised, but the difficulty has been to store it without considerable losses due to deterioration and insect damage. An experiment has been commenced on storage. The essentials are that the rice should be reasonably dry, that the sacks should not be in contact with metal or stone on which moisture will condense, and that the store should be ratproof and birdproof. These conditions are embodied in the rice store, and the factors now being compared are very good ventilation, protection against insects, and airtight storage.

Mr. G. H. Corbett, Senior Entomologist, in his report for the same period, states that some indication of the reduction in yield of rice which may be expected from attack by *Sogata furcifera* Horvath has been obtained in two cage experiments from padi sown in November 1938. Normally the yield from padi sown at this time is very low, but if protected from borers it is average. In the case in point, whilst padi growing in the open was not attacked, padi in cages was severely attacked by *Sogata*. The yield from the padi in the cages was slightly less than that from the padi in the open in spite of no borer attack in the cages and heavy borer attack in the open.

The result of a preliminary investigation to ascertain the agent responsible for seedless panicles suggests that *Sogata* is incriminated and, accordingly, other experiments specifically concerned with *Sogata* have been projected.

Field trials with derris against padi insects, especially borers, in view of the results obtained from tank experiments, are under consideration.

Special investigations into the control of insects damaging stored padi and rice have been commenced.

Sugar

Cane

Antigua.—The following report, prepared by Mr. F. H. S. Warneford, Agricultural Superintendent, on investigational work conducted during the half-year ended December 31, 1938 has been received:

The experiments herein reported form portion of a comprehensive series of experiments conducted under the auspices of the Antigua Sugar Cane Investigation Committee and under the direction of Mr. P. E. Turner, Adviser in Sugar Cane Experiments to the Commissioner of Agriculture.

Originally the experiments on the Gunthorpe, Tudway and

Codrington Estates and on Delaps were under the control of Mr. C. F. Charter, Agronomist to the Gunthorpe Estates, while the remaining experiments were under the control of the Agricultural Department. Mr. Charter, however, left Antigua during 1937 and those experiments planted by him for the 1938 crop were reaped under supervision by the Agricultural Department.

A summary of the results of certain of these latter experiments is given below. Details as to sites, layout of experiments and yield data with respect to those experiments entirely under the control of the Department have also been furnished to the Imperial Institute, but they are too lengthy to be printed here.

The Agricultural Superintendent desires to express his thanks to Mr. Turner for soil analyses, for statistical analysis of the results and for general advice and assistance in the preparation of the report.

Varietal Experiments

The conclusions recorded in the 1937 report have in general been confirmed by the results obtained in 1938.

B.2935 has proved the outstanding variety both as plant cane and as a ratoon on soils of the Fitches suite, filling first place as a plant cane at Comfort Hall and at Vernons,[1] and as a ratoon at Gaynors, High Point and Cassada Garden.[1]

B.2935 has done well as a plant cane on a Gunthorpe Clay at Blakes but has been beaten by Ba.11569 and B.H.10.12 on Gunthorpe Clay at North Sound [1] and Otto Clay at La Roches.

It has failed completely as a ratoon on a soil transitional between Fitches and Gunthorpe Clays at Yeamans and on Blubber Valley Loam at Jolly Hill, and has been beaten by P.O.J.2878 and Ba.11569 as a ratoon on Gunthorpe Clay at Fitches Creek.

It has done well as a ratoon on a Tomlinson Clay,[1] almost equalling Ba.11569. This field was well cambered, and the plant cane crop received phosphate and nitrogen.

B.2935 can now be confidently recommended as the best variety for soils of the Fitches suite. Its extension on other soils should be watched with care as on heavy poorly drained soils there is a marked tendency for failure in the ratoon crop.

Ba.11569 has done well both as a plant cane and as a ratoon in all the experiments in which it was included. This variety is the most suitable on Gunthorpe, Otto and Tomlinson Clays, and almost certainly on Lindsey Clays for which precise experimental results are still lacking.

Ba.11569 also gives good results on the Blubber Valley soils, where, however, P.O.J.2878, although not a good factory

[1] Experiments planted by C. F. Charter.

cane, is a possible competitor, especially on wet poorly-drained grassy soils where its ready germination, spreading habit and early closing is definitely reducing weeding costs.

B.147(B4507) has now proved definitely inferior to B.2935 and Ba.11569 even on the soils of Fitches suite, the soil type on which it ever succeeded—*vide* experiments at Vernons,[1] Comfort Hall, Gaynors, High Point and Cassada Garden.[1] Cultivation of this variety should be discontinued.

B.H.10.12 has been beaten by B.2935 and Ba.11569 in all experiments on Fitches Clay in which it has been included, and by Ba.11569 in the experiments on the other soil types on which they both have been grown. This variety has done well on alluvial soils (Bendal and Blubber Valley soils), on Fitches Clays, Calcareous Gunthorpe Clays and the more fertile Otto Clay soils under conditions of fair rainfall, but it appears that on most of these soils heavier yields will be obtained from Ba.11569.

B.H.10.12 and Ba.11569 are now being compared in a varietal trial on Bendal Clay at the Greencastle Experiment Station.

In experiments in which it has been included the yield of B.726 has been much the same as that of B.H.10.12.

Co.213 is grown to some extent on certain shallow soils on hillsides in the north and north-east parts of the island, and on Tomlinson Clays in the Paynters area. It has proved inferior as a plant cane to B.2935 and Ba.11569 on Fitches Clay at Comfort Hall and also on Tomlinson Clay at Tomlinsons. It is generally an easily established variety with rapid spreading early growth in virtue of which it succeeds in fields where cultivation is indifferent or which are grassy.

Manurial and Cultural Experiments

It was stated in the Report for 1937 that experimental results to date indicated that considerable immediate gains in yield can be obtained by the application of inorganic fertilisers to Antigua soils, and that these gains can exceed those resulting from an average application of pen manure.

Manurial experiments reaped as plant canes during 1938 have indicated that the immediate gains from inorganic fertilisers may be smaller in a season where abnormal rainfall is experienced during the early months of the cane's life. Under such conditions as existed in December 1936 and January and February 1937 the availability of the soil phosphate is likely to be greater than is normally the case at that time of year, so that the need for additional phosphate is less, and moreover the rate of growth of the plants is likely to be

[1] Experiments planted by C. F. Charter.

accelerated to such an extent as to reduce the age at which early manures should be applied if they are to be effective.

Significant responses to inorganic manures have, however, been observed at several stations. Considerable gains from nitrogen as sulphate of ammonia in the presence of basal phosphate and potash resulted on Gunthorpe Clay at Cassada Garden, No. 13,[1] and on Bendal Clay at Belvidere. Only small and statistically non-significant gains from sulphate of ammonia in the presence of phosphate and potash were observed on Fitches Clay at Long Lane and at Cedar Valley[1] and on Gunthorpe Clay at Fitches Creek[1]; in the latter experiment, however, there was no treatment entirely without nitrogen.

Small but significant gains in yield from phosphate together with potash have been observed on Gunthorpe Clay at Fitches Creek 17,[1] while gains from both phosphate and potash have resulted on Fitches Clay at Cedar Valley,[1] from phosphate on Gunthorpe Clay at Cassada Garden, and from potash on Otto Clay at Ottos. In the three last quoted experiments phosphate and potash have been applied in the presence of basal nitrogen.

No significant gains from phosphate or potash were observed in the presence of basal nitrogen on Gunthorpe Clay at Fitches Creek 23,[1] nor on Fitches Clay at Winthorpes, Langfords and Cassada Garden 27[1] under the rainfall conditions which obtained.

No gains from a complete inorganic manure resulted on a highly calcareous Fitches Clay at Betty's Hope.

Only one experiment in which pen manure was applied to plant canes was reaped as a plant cane during 1938. In this experiment on Bendal Clay at Greencastle Experiment Station which contained no "no manure" plots, there was no statistically significant difference in yield between the pen manure and the complete inorganic plots.

Residual gains in yield from pen manure were observed in the second ratoon crop at Pares and Cochranes on Fitches Clay and on first ratoons on Fitches Clay at Long Lane and Parham Old Work[1] and on a transitional soil (Fitches Clay and Gunthorpe Clay) at Ffryes.

At Long Lane and at Ffryes immediate gains in the plant cane resulting from a complete inorganic had exceeded those from pen manure alone. In the case of the first ratoons the resulting gains from the complete inorganic fertiliser applied to the ratoons exceeded the residual gains from pen manure at all three stations.

Considerable and statistically significant gains in yield of the first ratoon crop resulted from the application of sulphate

[1] Experiments planted by C. F. Charter.

of ammonia to the ratoons at Millars and Bodkins on Fitches Clay and Gunthorpe Clay respectively. Significant and considerable gains in yield resulted from applications of sulphate of ammonia and of phosphate to ratoons at Sandersons (Gunthorpe Clay). The gains from each fertiliser being the greater when both were applied together. Similar results were obtained on Gunthorpe Clay at Fitches Creek[1] and at Cassada Garden.[1] On Fitches Clay at the Diamond significant gains in yield of first ratoons resulted from applications of sulphate of ammonia and of phosphate.

On Gunthorpe Clay at North Sound[1] significant gains in yield of ratoons followed applications of sulphate of ammonia and of sulphate of potash.

In all these experiments statistically significant gains in yield of the plant cane crop had resulted from inorganic fertilisers.

It has long been customary to apply sulphate of ammonia to ratoons, but frequently this practice is omitted in the case of second ratoons. At Greencastle on Bendal Clay a gain in yield of second ratoons of 3·31 tons cane per acre has resulted from application of 2 cwt. sulphate of ammonia.

Residual gains in yield from trash mulch applied to the plant cane crop were observed on first ratoons on Fitches Clay at Winthorpes. These gains were greatest in the presence of a complete inorganic manure applied both to the plant canes and to the ratoons.

In one experiment on a highly calcareous Fitches Clay, small but significant gains in yield resulted from spraying with ferrous sulphate. The response to fertilisers on such soils may be determined not only by the available iron but also by the availability of such elements as magnesium, manganese and boron. Two experiments with these three elements have been planted at the end of 1938 for reaping in 1940.

One experiment on a highly calcareous Fitches Clay was conducted with the varieties B.H.10.12 and Ba.11569 subjected to various soaking treatments—Nil, 0·5 per cent. ferrous sulphate solution and saturated lime water. In the case of both varieties germination and total yield were highest with the plants soaked in lime water. In the case of Ba.11569 germination and yield were higher for the plants soaked in ferrous sulphate than for the unsoaked plants; the reverse was true for B.H.10.12.

Our present knowledge of the manurial requirements of sugar cane in Antigua may be briefly summarised as follows:

Plant canes will normally respond to early applications of pen manure, filter press mud and inorganic mixtures containing

[1] Experiments planted by C. F. Charter.

nitrogen and phosphate. Potash appears to be beneficial on certain soils but is less generally required than nitrogen and phosphate.

The beneficial effects of pen manure and of filter press mud persist in the ratoon crops.

Ratoons respond to applications of inorganic fertilisers, especially to sulphate of ammonia. On many soils, however, this response to nitrogen is greatest in the presence of phosphate. Occasionally potash is beneficial.

St. Kitts-Nevis.—The following report by Mr. R. E. Kelrick, Agricultural Superintendent, on work undertaken by the Agricultural Department during the half-year ended June 30, 1939, has been received:

Thirty-eight variety, manurial and cultural experiments with sugar cane were reaped during the period under review. These experiments are conducted in co-operation with the Sugar Cane Investigation Committee and are planned by Mr. P. E. Turner, M.Sc., F.I.C., Adviser in Sugar Cane Experiments to the Commissioner of Agriculture.

Eleven variety trials were reaped. Ten of these were experiments with plant canes, and several new varieties produced at the Central Sugar Cane Breeding Station in Barbados were included for the first time. The results of the experiments show that the varieties B.2935 and B.3439 are capable of giving very high yields when grown on the dry areas of the island. When planted too early B.2935 rots appreciably, and B.3439 arrows freely and shows a tendency to become pithy. No outstanding results were given by the varieties B.3013, B.3124, B.3127 and B.3138.

The average gain in yield from a mulch of trash 6 in. deep applied between the rows of plant canes was 0·82 tons cane to the acre. This gain could not be established as statistically significant. No interaction between the mulching and manurial treatments was found to obtain. There was an average gain in yield from potash of 3 tons cane per acre.

The results of the manurial trials are shown in the following tables.

Fish Manure and Inorganic Manure

Early Manure per acre.	Yield of plant canes (tons per acre).		
	Hope Estate.	Stapleton Estate.	Bourkes Estate.
Nil	27·86	36·52	26·67
4 cwts. fish manure . . .	27·92	37·95	34·46
2 cwts. sulphate of ammonia 1½ cwts. muriate of potash . 1½ cwts. superphosphate .	28·63	38·97	36·83

All plots were given a late basal dressing of sulphate of ammonia at the following rates: Hope and Stapleton 3 cwts. per acre, and Bourkes 2 cwts. per acre.

PEN MANURE, FISH MANURE AND INORGANIC MANURE

Early Manure per acre.	Yield of plant canes (tons per acre).	
	Caines.	Buckleys.
Nil	28·46	53·08
25 tons (approx.) pen manure	35·36	64·44
4 cwts. fish manure	29·33	60·74
1½ cwts. sulphate of ammonia; 2 cwts. muriate of potash; 1½ cwts. superphosphate	29·87	60·11

All plots were given a late basal dressing of 2 cwts. sulphate of ammonia to the acre.

SIZE OF DRESSING OF PHOSPHATE ON UNPENMANURED SOIL

Superphosphate per acre.	Yield of plant canes (tons per acre).		
	Willetts.	West Farm.	Mansion.
Nil	37·63	30·05	39·80
1 cwt.	32·46	32·39	39·43
2 cwts.	31·46	30·64	38·63

All plots were given basal dressings of early potash and early and late sulphate of ammonia.

At West Farn the dressing of 1 cwt. and 2 cwts. superphosphate to the acre gave rise to gains of 2·34 tons and 0·59 tons of plant canes respectively. The difference between the two gains might be due to chance less than once in 10 times. It would appear inadvisable to apply a dressing of superphosphate larger than 1 cwt. to the acre to plant canes under the conditions which obtain on this experimental area.

At Mansion differences in yield due to treatment with superphosphate were not statistically significant.

At Willetts the average loss in yield from treatment with superphosphate might be due to chance less than once in 100 times.

POTASH ON UNPENMANURED SOILS
Milliken Estate (1938 and 1939 crops).

Muriate of Potash per acre.		Yields of cane (tons per acre).			
Plant canes.	1st Ratoons.	Plants.	1st Ratoons.	Total.	Difference.
Nil	Nil	32·04	20·80	52·84	—
Nil	1 cwt.	33·19	26·03	59·22	6·38
1½ cwts.	Nil	39·01	27·37	66·38	13·54
1½ cwts.	1 cwt.	39·91	28·44	68·35	15·51

All plots were given basal dressings of nitrogen and phosphate as plant canes.

Gains in yield of plant canes and ratoons exceeding 3·03 tons and 3·66 tons of cane respectively, might be due to chance less than once in 100 times.

SIZE OF DRESSING OF POTASH ON UNPENMANURED SOIL

Buckleys Estate.

Muriate of Potash per acre.	Yield of plant canes (tons per acre).	Gain (tons per acre).
Nil	27·43	—
1 cwt.	30·89	3·46
2 cwts.	31·67	4·24

All plots were given an early dressing to the acre of 2 cwts. sulphate of ammonia and 1½ cwts. superphosphate. A late basal dressing of 3 cwts. sulphate of ammonia to the acre was applied.

The average gain in yield from treatment with potash might be due to chance less than once in 100 times.

On three estates experiments with manganese, copper, zinc and boron on plant canes were carried out, but in no case was any effect of these elements on the yield of cane observed.

The result of a cultural experiment on plant canes is shown below.

Cultural Treatment.	Yield of plant canes (tons per acre).	
	Mills.	Cunningham.
Subsoiled and cultivated	40·77	45·27
Nil	42·38	39·58
Difference	1·61	5·69

The differences in yield cannot be established as statistically significant.

FRUITS

Citrus

Dominica.—The following account of work on various citrus fruits is contained in the report of Mr. H. B. Pidduck, Acting Agricultural Superintendent, for the half-year ended June 30, 1939.

(1) *Lime Breeding.*—The twenty-three hybrids planted last year have nearly all flowered and are being back-crossed to old West Indian trees. A few seeds obtained from Tahiti Limes (Bear's Seedless) pollinated with West Indian pollen have been sown. It remains to be seen whether these are true hybrids.

(2) *Stock Trials for Limes.*—Yields of limes budded on grapefruit stock continue to be higher than those on sour orange, which in turn are higher than those on rough lemon. Recent yields have been depressed by unfavourable weather, but the prospects for the main crop are good. Rough lemon has proved more liable to gummosis than other stocks in the Northern District.

(3) *Grapefruit and Orange Varieties.*—Good progress is to be recorded. To applications of pen manure and surface mulch of lemon grass is attributed a fair late crop, much of this having been lost on estates not employing these methods. So far no variety on trial has proved much earlier than others, but Lamb's Summer orange is definitely much later and will therefore be of use in extending the season.

(4) *Government Fruit Farm.*—Soil analyses carried out by Professor Hardy, of the Imperial College of Tropical Agriculture, having indicated a very satisfactory nutrient status in most of the citrus plots, the funds normally devoted to artificial manures have been applied to extension of wind-breaks and cover crops. In plots found to be deficient in phosphate and lime, however, experiments are being continued to determine the optimum quantities required. This is a long term experiment and no tangible results are as yet forthcoming.

(5) *Plant Distribution.*—Extensive irrigation and watering have had to be carried out in the citrus nurseries, but apart from rather slow growth, the plants look remarkably healthy. Distribution of budded citrus is expected to commence about mid-July and also the transplanting of sour orange rootstocks for budding for 1939. It has been made abundantly clear that of the two extremes a protracted drought is preferable to excessive rains, provided there is a supply of water for irrigation, and humus in the soil.

(6) *Lime Experiment Station.*—In addition to trials with West Indian limes budded on different rootstocks and planted at varying distances and on varying slopes, trials are also being conducted with limes top-worked on grapefruit budded on sour orange, Bear's Seedless limes similarly worked on Valencia orange and West Indian limes planted under shade. These trials have been mentioned previously, and at the moment there is nothing further to report. Their aim is to improve yields.

(7) *Top-working of Citrus Trees.*—As a result of an experiment commenced in 1934 to convert budded trees into some other species or variety of citrus, a routine technique has been evolved for the conversion of any undesirable type in the field without replanting, and during the past six months the department has again assisted estates in this work, more particularly in the conversion of unsaleable seedy grapefruit to the Marsh Seedless variety and to Washington navel oranges.

Montserrat.—Mr. W. E. Bassett, Curator of the Agricultural Department, in his report for the half-year ended June 30, 1939, makes further reference to the rootstock trial laid down in 1937 which has been described in earlier reports. No differences between the behaviour of the trees on the various stocks has so far been observed. Some trees on each kind of stock are in an unsatisfactory condition and appear to be suffering from the effects of exposure to wind. The need for adequate protection of young trees by cover crops and the more general use of permanent windbreaks in Montserrat is indicated.

Tomatoes

Montserrat.—Mr. W. E. Bassett, Curator of the Agricultural Department, in his report for the half-year ended June 30, 1939, states that the tomato crop picked for export during the past few months was adversely affected, with regard to both quantity and quality, by exposure to wind. An experiment to try out the use of sugar-cane as a windbreak for tomatoes has been laid down. The tomatoes will be planted in plots about 50 ft. square surrounded by strips, some 12 ft. wide, of first ratoon canes.

Oil Seeds

Coconuts

Malaya.—The following statement on work on copra is contained in the report by Mr. F. C. Cooke, Chemist, Coconut Products, for the half-year January-June 1939.

(1) It is undesirable in Malaya to harvest unripe nuts but considerable loss of copra occurs if, in order to avoid harvesting unripe nuts, no nuts are cut and fallen nuts only are collected monthly. This is owing to extensive germination of nuts on the ground.

(2) A careful study has been made of the monthly recordings of the crop of nuts and copra collected from test plots laid down in an area of defective palms, the nuts from which yield a high percentage of "rubbery" copra. The results showed that the quality of the copra was not materially

bettered by any of the treatments, though treatment with lime showed some effect.

It is now apparent that the leading cause is absence of effective soil water movement.

(3) The effect of storing under various conditions copra of different qualities has been studied. Trials carried out under normal conditions of collection and warehousing indicate that:

(*a*) Underdried copra is progressively more susceptible to decomposition than dry copra whatever the conditions of storage. The loss of copra that results increases rapidly with increasing moisture content.

(*b*) Underdried copra will show greater decomposition and loss when stored in small quantities than when stored in bulk, especially if there has been careless preparation.

(*c*) It is good practice to build up loose copra into huge stacks so that it is able to dry rapidly by its own heat of decomposition. This limits the amounts of decomposition and incidental loss of copra.

(4) The performance of small copra cabinets constructed of attap alone, attap and plank, and plank and galvanised iron is still being systematically investigated. Cabinets of the original design have been successfully operated by large numbers of smallholders, but a small change in design permitting larger loads and increasing the heat efficiency has now introduced an entirely new set of conditions, necessitating the reconsideration of all details of operation.

Ground-nuts

Nigeria.—The report of Mr. W. E. Freeman, Botanist, Northern Provinces, for the half-year January-June 1939 contains the following statement regarding trials with ground-nuts.

Trials at Samaru.—Three variety trials were carried out at Samaru this year and can be summarised as follows:

*Trial B.*3 (38).—This consisted of a trial of Castle Cary with four later selections made from it and local mixture. The layout was a randomised block, but the trial was not significant. Castle Cary itself yielded only 92 per cent. of standard, while the later selections were not a great deal better. The trial will be repeated next year.

*Trial B.*4 (38).—This consisted of a variety trial with "Samaru 38" against six later selections from it and local mixture as standard. Castle Cary was also included for comparison. The layout was a randomised block, and the experiment was significant when P = 1 per cent. and a difference of 14 per cent. over standard was required to show

significance. Three sub-strains of "Samaru 38" were significantly better than standard with percentage increases of 17, 15 and 15 per cent., respectively. All strains of the "Samaru 38" group were better than standard, while Castle Cary was again poor with only 91 per cent.

*Trial B.*5 (38).—This was a trial of "Samaru 38," Castle Cary and three other unconnected strains against local mixture. The trial was significant at P = 5 per cent. An increase of 9 per cent. was necessary to be significant, and this was only attained by "Samaru 38." Castle Cary was again poor with only 99 per cent. of standard.

Trials at Kano.—Ground-nut variety trials were also carried out at Kano, with the following results:

*Trial K.*3 (38).—This consisted of four members of the "G" group tried out with the Kano local mixture in a Latin square. The trial was significant at P = 1 per cent., and an increase of 4·2 per cent. over standard was necessary for significance. All the four strains were thus better with increases ranging from 8 to 16 per cent.

*Trial K.*4 (38).—This consisted of four members of the "D" group against local mixture. "Kano 38", mentioned in previous reports, is one of the D group. The layout was a Latin square and was significant at P = 5 per cent., a difference of 8·3 per cent. of standard being significant. Three of the four strains were significant, with increases of 14, 13 and 12 per cent. respectively, but the fourth was not significantly better, having an increase of only 5 per cent.

Trial K.5 (38).—In this trial were incorporated two strains of the D group (one was "Kano 38"), one of the G group, Castle Cary and local mixture. The layout was a duplicated Latin square which was significant at P = 1 per cent. An increase over standard of 14 per cent. was necessary for significance, and this was attained by all except Castle Cary, which was only 12 per cent. better. The strain of the G group was actually best with an increase over standard of 36 per cent., "Kano 38" next with 23 per cent. increase, and then the other member of the "Kano 38" group with 15 per cent. increase.

Oil Palm

Malaya.—The report of the officers of the Agricultural Department for the half-year January-June 1939 contains the following statements regarding the oil palm.

Mr. R. B. Jagoe, Botanist, reports that the records of an experiment on correlation of rainfall and environment with yields of fruit have been completed and analysis is in progress. It seems clear that there is correlation between rainfall and

yield, but that such factors as height of water-table, contemporary yields or absence of fruit, mineral deficiencies and degree of pollination may complicate the relationship.

According to Mr. T. A. Buckley, Acting Senior Chemist, freshly separated oil palm nuts undergo self-heating (which is a commonly adopted drying process) only when they are stacked in sufficient bulk with access of air. In small quantities, drying is delayed and the kernels suffer degeneration, while the oil becomes acid. With exclusion of air and no artificial drying, the kernels become acid to litmus, but there is no deterioration of the oil. The self-heating is due to aerobic organisms, and thermophilic bacteria multiplying at 63° C. have been isolated.

Nigeria.—The following statement by Mr. F. W. Toovey is taken from the Botanist's Report, Southern Provinces, for the half-year January-June 1939.

Oil Palm Research Station.—As foreshadowed in previous reports an Oil Palm Research Station is being established in Nigeria. An area of 4,000 acres has been acquired in the Ekiadolor Forest Reserve, Benin Province, and it is intended that this shall form the main station for the breeding work, cultural experiments and seed multiplication. It was quite impossible to obtain so large an area in the main Oil Palm Belt in the Eastern Provinces, but fortunately the conditions in Benin Province are very similar to those in the palm belt proper. To duplicate the more important cultural experiments a site for a sub-station in the Eastern Provinces is being sought.

The first planting of palms at the main station has recently been done (June 1939). Two selection plots have been commenced and the planting took place under favourable conditions. One plot is devoted to the progenies of thick-shelled selections and the other to the progenies of thin-shelled selections. Only progenies of the Aba selections were planted. In the plot of thin-shelled progenies part of the area was planted with the double purpose of a progeny trial and a statistical experiment to compare self-pollination with cross-pollination. Progenies of the three Aba thin-shelled selections, UZ931, UZ864 and UZ707, were employed in the self- versus cross-pollination experiment. In this experiment, each row, consisting of 24 palms, is a plot. This plot size is consistent with the available uniformity data for Nigerian palms (see "A Note on a Uniformity Trial with Oil Palms," C. C. Webster, *Tropical Agriculture*, 1939, XVI, pp. 15-19). Self-pollinated progeny of each of three selections, and progeny of the crosses UZ864 × UZ707, UZ931 × UZ707 and UZ931 × UZ864 (the

female parent given first in each case) were used. The statistical layout was designed by Mr. G. K. G. Campbell, Botanist.

Germination of Oil Palm Seed.—It is possible to report still further improvement in the germination of oil palm seed through the use of artificial germinators at Ibadan. The results for 1937 were given in the previous report (this BULLETIN, 1939, **37**, 211). In the following table the results for both 1937 and 1938 are given, for comparison.

Year.	No. of Seeds sown during the year.	Germination after six months.		Germination after nine months.	
		Total.	Percentage.	Total.	Percentage.
1937 . .	42,973	9,534	22·2	22,331	52·0
1938 . .	74,652	33,076	44·3	?	70 (?)

The 1938 figure for germination after 9 months is not yet definite, but it will certainly exceed 70 per cent.

These results are considerably better than those obtained three or four years ago when average germination of the order of 1 per cent. in 12 months was frequently obtained.

FIBRES

Manila Hemp

Malaya.—Mr. T. D. Marsh, Acting Senior Agriculturist, in his report for the half-year January-June 1939 states that, in addition to varietal trials laid down on Valley and Hill Quartzite soils, an experiment has been commenced in a valley on newly-felled 18-year-old secondary jungle to test the suitability of these conditions in Malaya to this crop. The experiment is also designed to ascertain whether the plants prefer to be associated with a companion crop, which does not actually provide shade but helps to maintain at all times a high degree of atmospheric humidity and assists the ground covers to shade the soil surface.

DRUGS

Cinchona

Malaya.—Mr. T. A. Buckley, Acting Senior Chemist, in his report for the half-year January-June 1939, gives the following analyses of bark from two *Cinchona ledgeriana* trees grown at Cameron Highlands. The figures represent the average results for the whole bark (stem, branch and root) expressed on a moisture-free basis.

Tree No. 1—9·02 per cent. quinine alkaloid.
Tree No. 2—9·07 per cent. quinine alkaloid.

BIBLIOGRAPHY

Comprising the more important reports, articles, etc., contained in publications received in the Library of the Imperial Institute during the three months May-July 1939.

The publications issued by the Governments of the Colonies and Protectorates can be obtained from or through the Crown Agents for the Colonies, 4 *Millbank, Westminster, S.W.*1. *Applications for Dominion and Indian Government publications may be made to the Offices of the High Commissioners or Agents-General in London.*

AGRICULTURE

General

Report by Sir Frank Stockdale, Agricultural Adviser to the Secretary of State for the Colonies, on a Visit to Malaya, Java, Sumatra and Ceylon, 1938. Pp. 108, 9½ × 6. (London : Colonial Office, 1939.)

Reports on the Work of Agricultural Research Institutes and on certain other Agricultural Investigations in the United Kingdom, 1935-1936. Pp. 337, 9½ × 6. (London : H.M. Stationery Office, 1939.) Price 5*s*.

Twenty-seventh Report of the Department of Agriculture for Scotland for the year 1938. Pp. 179, 9½ × 6. (Edinburgh : H.M. Stationery Office, 1939.) Price 3*s*.

Agricultural Research in Scotland in 1938. A Brief Summary of Work at the Scottish Agricultural Research Stations during the year. *Trans. Highl. Agric. Soc., Scot.*, 1939, **51**, 175-190.

Annual Report of the Department of Agriculture and Stock, Queensland, for 1937-38. Pp. 172, 13 × 8. (Brisbane : Government Printer, 1938.)

Annual Report of the Agricultural and Marine Products Board, Bahamas, for the year ended December 31, 1938. Pp. 19, 10½ × 6¾. (Nassau : Government Printer, 1939.)

Annual Report of the Department of Agriculture, Basutoland, for the year ended September 30, 1938. Pp. 77, 8½ × 5½. (Maseru : Department of Agriculture, 1939.)

Report of the Department of Agriculture, Bermuda, for 1938. Pp. 63, 13 × 8. (Hamilton : Government Printer, 1939.)

Report of the British Guiana Refugee Commission to the Advisory Committee on Political Refugees appointed by the President of the United States of America. Pp. 17, 9½ × 6. (London : H.M. Stationery Office, 1939.) Price 4*d*.

Canadian Types of Farming. By R. Peet and W. Allen. *J. Minist. Agric.*, 1939, **46**, 230-237.

Annual Report of the Department of Agriculture, Province of Prince Edward Island, for the year ending December 31, 1938. Pp. 103, 10 × 6¾. (Charlottetown, P.E.I. : Department of Agriculture, 1939.)

Administration Report of the Acting Director of Agriculture, Ceylon, for 1937. Pp. 93, 9¾ × 6. (Colombo : Government Record Office, 1938.) Price Re. 1.

Report of the Botanical Survey of India for 1937-38. Pp. 12, 9½ × 6½. (Calcutta : Government of India Press, 1938.)

Scientific Reports of the Imperial Agricultural Research Institute, New Delhi, for the year ending June 30, 1938. Pp. 131, 9¾ × 7¼. (Delhi : Manager of Publications, 1939.) Price Rs. 3 As. 4.

Annual Report of the Department of Agriculture, Bengal, for the

year 1937-38. Part I. Pp. 20, 9¾ × 6½. (Alipore, Bengal: Superintendent, Government Printing, 1938.) Price As. 8.

Annual Report of the Department of Agriculture, Bengal, for 1937-38. Part II. Pp. 338, 9¾ × 6½. (Alipore, Bengal: Superintendent, Government Printing, 1938.) Price Re. 1 As. 4.

Report on Demonstration Work carried out in the Southern Circle, Department of Agriculture, Central Provinces and Berar, together with Reports on the Seed and Demonstration Farms of the Circle for the year ending March 31, 1938. Pp. 57, 9½ × 6¼. (Nagpur, C.P.: Government Printing, 1939.) Price Re. 1 As. 8.

Report on Demonstration Work carried out in the Eastern Circle, Department of Agriculture, Central Provinces and Berar, together with Reports on the Seed and Demonstration Farms of the Circle for the year ending March 31, 1938. Pp. 50, 9½ × 6¼. (Nagpur, C.P.: Government Printing, 1939.) Price Re. 1 As. 8.

Mysore Agricultural Calendar for the year from March 22, 1939, to April 8, 1940. Pp. 103, 9¾ × 6. (Bangalore: Superintendent, Government Press, 1939.) Price As. 2.

Annual Report of the Department of Agriculture, Kenya Colony and Protectorate, for 1937. Volume II. Pp. 103, 9¾ × 6. (Nairobi: Government Printer, 1939.) Price 2*s.* 50 cents. Comprises accounts of work of the Coffee Service, the Botanical Section, the Plant Breeder, the Chemical Section and the Entomological Section.

Inlichtingen en Onderzoekingen van de Afdeeling Handelsmuseum, Koninklijke Vereeniging Koloniaal Instituut, Amsterdam, in 1938. *Meded. No.* 49, *Kolon. Inst. Amst.* Pp. 132, 9 × 6¼. (Amsterdam: Koloniaal Instituut, 1939.) Price f. 2.

Report on the Progress of Co-operation in Nigeria, 1937-38. Pp. 23, 13 × 8. (Lagos: Government Printer, 1939.) Price 2*s.*

Annual Report of the Department of Agriculture, Northern Rhodesia, for the year 1938. Pp. 26, 13 × 8. (Lusaka: Government Printer, 1939.) Price 2*s.*

Report of the Agricultural Survey of the five most Northerly Districts of Nyasaland. Pp. 103, 13 × 8. (Zomba: Government Printer, 1938.) Price 7*s.* 6*d.*

Report on the Department of Agriculture, St. Lucia, for the year 1937. Pp. 45, 13 × 8. (St. Lucia: Government Printing Office, 1939.) Price 6*d.*

Annual Report of the Department of Agriculture, Uganda Protectorate, for the year ended June 30, 1938. Part II. Pp. 99, 9¾ × 6. (Entebbe: Government Printer, 1939.) Price 4*s.* An account of the activities of the staff of the Laboratories Division of the Department and records the experimental work carried out by them and by officers of the Field Division.

Golden Anniversary Report for the year ending June 30, 1938, of the Agricultural Experiment Station, University of Florida. Pp. 198, 9 × 6. (Gainesville, Florida: Agricultural Experiment Station, 1939.)

Annual Report on the Department of Agriculture, Zanzibar Protectorate, for the year ended December 31, 1938. Pp. 38, 13 × 8. (Zanzibar: Government Printer, 1939.) Price 2*s.*

The Trend of Progress in Crop Production. By Sir E. J. Russell. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 644-648.

Plant Breeding in New South Wales, 1937-38. *Sci. Bull. No.* 66, *Dep. Agric. N.S.W.* Pp. 61, 9½ × 6. (Sydney: Government Printer, 1939.)

The Use of Hormones as an Aid to the Propagation of Plants. By B. W. Doak. *N.Z. J. Sci. Tech.*, 1939, **20**, 269A-280A.

Overhead Irrigation. By E. Skillman. *J. Minist. Agric.*, 1939, **46**, 171-175.

American Bramble. By E. J. Phillips, J. J. Harding and R. du Toit. *Frmg. S. Afr.*, 1939, **14**, 272-274. General account of this weed and methods of control.

Chemical Composition of Prickly Pear. Relation to Parasitism by Cactoblastis. By M. S. Benjamin and A. N. Old. *Agric. Gaz. N.S.W.*, 1939, **50**, 240-276.

The Soil

Current Problems in Erosion Control. By R. M. Gorrie. *Indian For.*, 1939, **65**, 254-264. Notes on local experience in the Hoshiarpur District, Punjab.

New Aspects of Nitrogen Fixation and Conservation in Tropical Soils. By G. T. Kalé. *Int. Rev. Agric.*, 1939, **30**, 161T-173T.

Arsenical Soils of the Waiotapu Valley, New Zealand. Evidence of Poisoning of Stock at Reporoa. By R. E. R. Grimmett. *N.Z. J. Agric.*, 1939, **58**, 383-391.

Natural Reversion to Grass. Observations on the Effect upon Soil Fertility of (*a*) Established Grass and (*b*) Clover as compared with Natural Reversion to Grass. By D. C. Edwards. *E. Afr. Agric. J.*, 1939, **4**, 411-414.

Soil Survey of Wairau Plains, Marlborough. By C. S. Harris and K. S. Birrell. *Bull. No.* 72, *Dep. Sci. Industr. Res. N.Z.* Pp. 29 + map, 9½ × 6. (Wellington, N.Z.: Government Printer, 1939.) Price 2*s*.

The Depreciation of Soil Productivity. *Queensld. Agric. J.*, 1939, **51**, 403-414. Deals mainly with soil erosion in Australia.

Sewage Irrigation as practised in the Western States. By W. A. Hutchins. *Tech. Bull.* No. 675, *U.S. Dep. Agric.* Pp. 59, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 15 cents.

Practical Composting. A Plea for Adapting the Technique to the Raw Material and the Environment. By G. B. Masefield. *Trop. Agric., Trin.*, 1939, **16**, 99-100.

The Natural Decomposition of Bat Manure. By J. V. Nel. *Sci. Bull. No.* 180, *Dep. Agric. Un. S. Afr.* Pp. 21, 9½ × 6. (Pretoria: Government Printer, 1939.)

Psammophytes Argentines qui Peuvent être Employées pour Fixer les Dunes. By L. Parodi. *Rev. Bot. Appl.*, 1939, **19**, 389-395. Psammophytes of the Argentine which can be used for dune fixation.

A Study of the Soils in the Hill Areas of Kashmir. An Investigation of Soil Profiles under Deodar, Blue Pine, Silver Fir and Chir. By R. C. Hoon. *Indian For. Rec.* (*New Series*) *Silvic*, **3**, No. 6. Pp. 67, 9¾ × 7½. (Delhi: Manager of Publications, 1939.) Price Re. 1 As. 14.

Bibliography of References to the Literature on the Minor Elements and their relation to Plant and Animal Nutrition. Third Edition. Pp. 488, 11 × 8½. (New York: Chilean Nitrate Educational Bureau, Inc., 1939.)

Pests—General

Locusts in India and Their Control. By Y. Ramchandra Rao. *Agric. Live-Stk. India*, 1939, **9**, 233-247.

The Ticks of Domestic Animals in Britain. By J. Macleod. *Emp. J. Exp. Agric.*, 1939, **7**, 97-110.

The Rabbit Problem. By A. V. Campbell. *J. Minist. Agric.*, 1939, **19**, 282-289.

The Rabbit Menace. By C. W. Hume. *Emp. J. Exp. Agric.*, 1939, **7**, 132-138.

Insecticides

(See p. 405)

Foodstuffs—General

Review of Present Knowledge of Human Nutrition with remarks on Practical Measures taken by the Medical Department in the past to its Improvement in Sierra Leone. Pp. 46, 13 × 8. (Freetown: Government Printer, 1938.) Price 2*s.*

First Report of the Committee on Nutrition in the Colonial Empire. Part I. Nutrition in the Colonial Empire. Part II. Summary of Information regarding Nutrition in the Colonial Empire. Pp. 210 each part, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price, Part I, 3*s.*; Part II, 2*s.* 6*d.*

The Cultivation of Food Crops on Estates. By W. N. C. Belgrave. *Malay. Agric. J.*, 1939, **27**, 209-213. Food crops recommended for Malayan conditions.

Beverages

Drying of Cocoa Beans. *Gordian*, 1939, No. 1061, 39-40.

The Sources of Ephestia Infestation of Stored Cacao in Ceylon. By M. Fernando. *Trop. Agric., Ceylon*, 1939, **92**, 141-155.

The Cacao Industry in the Philippines. By E. A. Lanuza. *Philipp. J. Agric.*, 1939, **10**, 69-75.

Versuch einer Uebersicht über die Hauptgruppen der Kakaoarten. By H. Fincke. *Bull. Off. Int. Choc. Cacao, Brux.*, 1939, **9**, 229-231. A brief survey relating to the main groups of the various species of cocoa.

Progress Report on Work done on the Coffee Experiment Station, Balehonnur, for the period 1932 to 1936. *Bull. No.* 18, *Mysore Coffee Exp. Sta.* Pp. 41 + 13 plates, 9½ × 6. (Bangalore: Superintendent, Government Press, 1939.)

A Note on a Preliminary Investigation into Possible Rooting Media for Cuttings of *Coffea arabica*. *Quart. Notes Coffee Res. Sta., Lyamungu, Moshi*, 1939, No. 9, 7-10.

Conuga-koffie. By N. M. de Ligt. *Bergcultures*, 1939, **13**, 726-732. The cultivation and production of this variety of coffee (*Coffea congensis*) in Java.

De Koffiecultuur in Centraal- en Oost-Afrika. By R. van der Veen. *Bergcultures*, 1939, **13**, 819-823.

Rejuvenatie en Herontginning bij Koffie. By W. Snoep. *Bergcultures*, 1939, **13**, 804-810. Deals with the renewing of coffee plantations.

The Effect of Treating Coffee with Different Micro-floræ: with General Notes on Coffee Liquoring Reports. By G. H. G. Jones. *E. Afr. Agric. J.*, 1939, **4**, 451-456.

The Effects of Cultivation and Weeds on Tea. By T. Eden. *Tea Quart.*, 1939, **12**, Part 1, 24-37.

The Improvement of Planting Material. By F. R. Tubbs. *Tea Quart.*, 1939, **12**, Part 1, 38-47.

Observations on the Effects of Prolonged Drought on Tea. By J. D. Manning. *Plant. Chron.*, 1939, **34**, 317-320.

The Fermentation Process in Tea Manufacture. II. Some Properties of Tea Peroxidase. III. The Mechanism of Fermentation. By E. A. H. Roberts. *Biochem. J.*, 1939, **33**, 836-852.

Cereals

Grain Crops. A Summary of Figures of Production and Trade relating to Wheat, Wheat Flour, Maize, Oats, Barley, Rye and Rice. *Publication of the Imperial Economic Committee.* Pp. 141, 9¾ × 7. (London: H.M. Stationery Office, 1939.) Price 2*s.* 9*d.*

Common Pests of Grain and other Stored Produce. Pp. 18, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 3*d*. Prepared in connection with the Grain Infestation Survey on behalf of the Department of Scientific and Industrial Research.

Barley Growing. *Adv. Leafl. No.* 220 (*Revised*), *Minist. Agric., Lond.* Pp. 4, 8½ × 5½. (London: H.M. Stationery Office, 1939.) Price 1*d*.

Various Aspects of Malting Barley Breeding. By H. Hunter. *J. Inst. Brew.*, 1939, **45**, 286-298.

Situation Actuelle du Maïs dans le Monde. Position de la France et des Colonies Françaises. By P. Tissot. *Rev. Bot. Appl.*, 1939, **19**, 322-332, 421-427.

Seed Corn. By M. T. Jenkins. *Frms'. Bull. No.* 1822, *U.S. Dep. Agric.* Pp. 13, 9 × 6. (Washington, D.C.: Superintendent, Government Printing Office, 1939.) Price 5 cents. Deals with the selection and handling of maize seed for sowing purposes.

Control of the Corn Earworm (*Heliothis obsoleta*) on Fordhook Lima Beans in Eastern Virginia. By L. W. Brannon. *Circ. No.* 506, *U.S. Dep. Agric.* Pp. 14, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Oats. *Adv. Leafl. No.* 121, *Minist. Agric., Lond.* Pp. 4, 8½ × 5½. (London: H.M. Stationery Office, 1939.) Price 1*d*. The cultivation, harvesting and yield of the crop.

Improvement of Ratnagiri Rices by Breeding. Part I. By V. K. Patankar. *Bull. No.* 181 (1938), *Dep. Agric. Bombay.* Pp. 61, 9½ × 6. (Bombay: Superintendent, Government Printing and Stationery, 1939.) Price As. 4.

Report to Government on the Activities of the British Guiana Rice Marketing Board for the period September 1, 1938, to February 28, 1939. Pp. 5, 13 × 8½. (Georgetown, Demerara: Government Printer, 1939.)

Le Repiquage du Riz en Italie. By R. Piacco. *Riz et Rizic.*, 1939, **13**, 59-88. The transplanting of rice in Italy.

Effect of Sulphur Fumigation on Quality of Rice. By A. Sreenivasan. *Agric. Live-Stk. India.*, 1939, **9**, 149-154.

Studies on Quality in Rice. III. In Vitro Digestibilities of Different Varieties of Rice. By A. Sreenivasan and K. Venkata Giri. IV. Storage Changes in Rice after Harvest. By A. Sreenivasan. *Indian J. Agric. Sci.*, 1939, **9**, 193-222.

The Rice Mealy Bug in South India. By T. V. Rama Krishna Ayyar. *J. Mysore Agric. Exp. Un.*, 1939, **17**, 179-188.

Fifth Annual Report, for the year 1938, of the Wheat Research Institute, Christchurch, New Zealand. Pp. 26, 9½ × 6. (Wellington, N.Z.: Government Printer, 1939.) Price 1*s*.

South Australian Grain Studies. I. Variation in Protein Content and Diastatic Activity throughout the Wheat Belt of South Australia. By E. J. Breakwell and E. M. Hutton. *J. Dep. Agric. S. Aust.*, 1939, **42**, 683-699.

South Australian Grain Studies. II. Some Practical Implications of the Variation in Protein Content and Diastatic Activity of Grain from the South Australian Wheat Belt. By E. J. Breakwell and E. M. Hutton. *J. Dep. Agric. S. Aust.*, 1939, **42**, 767-780. A survey of the baking qualities of South Australian wheats.

Wheat Growing Costs [in South Australia]. By F. W. Coleman. *J. Dep. Agric. S. Aust.*, 1939, **42**, 727-729.

Analytical Yield Investigations on New Zealand Wheat. IV. Blending Varieties of Wheat. By O. H. Frankel. *J. Agric. Sci.*, 1939, **29**, 249-261.

Growing Wheat in the Eastern United States. By S. C. Salmon

and J. W. Taylor. *Frms'. Bull. No.* 1817, *U.S. Dep. Agric.* Pp. 58, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

A Yield Analysis of Egyptian Wheats. By J. Philp. *Bull. No.* 198, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 27, 10½ × 7¼. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price P.T. 3.

Wheat Production in Southern Rhodesia. By D. E. McLoughlin. *Rhod. Agric. J.*, 1939, **36**, 260-274.

Pulses

Manganese Deficiencies in Crops. I. Spraying Pea Crops with Solutions of Manganese Salts to Eliminate Marsh Spot. By A. H. Lewis. *Emp. J. Exp. Agric.*, 1939, **7**, 150-154.

Pea-streak (*Pisum virus* 3). By E. E. Chamberlain. *N.Z. J. Sci. Tech.*, 1939, **20**, 365A-381A.

Bean Mosaic (*Phaseolus virus* 1 of Smith, 1937.) By E. E. Chamberlain. *N.Z. J. Sci. Tech.*, 1939, **20**, 381A-388A. Describes symptoms, methods of transmission, control measures, etc.

Preliminary Studies on the Control of Bean Rust. By A. F. El-Helaly. *Bull. No.* 201, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 19 + 6 plates, 10¾ × 7¼. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price P.T. 3.

The Mexican Bean Beetle (*Epilachna varivestis* Muls.) and its Control in Missouri. By L. Haseman and C. W. Wingo. *Circ. No.* 199, *Mo. Agric. Exp. Sta.* Pp. 7, 9 × 6. (Columbia, Missouri. Agricultural Experiment Station, 1938.)

Une Plante Coloniale précieuse pour l'Alimentation. Le Haricot doré ou Boubour. By A. Chevalier. *Rev. Bot. Appl.*, 1939, **19**, 313-322. Notes on the cultivation and utilisation of *Phaseolus aureus*.

Sugar

Sugar-beet Growing. *Adv. Leafl. No.* 122, *Minist. Agric., Lond.* Pp. 4, 8½ × 5½. (London: H.M. Stationery Office, 1939.) Price 1*d*.

Sugar Beet Culture in the Humid Area of the United States. By J. G. Lill. *Frms.' Bull. No.* 1637 (*Revised*), *U.S. Dep. Agric.* Pp. 49, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Acidity and Manganese Deficiency Problems in Connexion with Sugar Beet Growing. By W. M. Davies. *Ann. Appl. Biol.*, 1939, **26**, 385-392.

The Effect of Boron on the Growth and Quality of Sugar Beet. By A. W. Greenhill. *Ann. Appl. Biol.*, 1939, **26**, 392-396.

Studies of Gaps in Sugar-cane Rows and their Effect upon Yield under Louisiana Conditions. By G. Arceneaux and I. E. Stokes. *Circ. No.* 521, *U.S. Dep. Agric.* Pp. 20, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

La Culture de la Canne et l'Industrie Sucrière en Cochinchine. La Sucrerie de Hiêp-Hoa. *Bull. Écon. Indochine*, 1939, **42**, 207-212.

Dryage and Deterioration of Cut Cane on the Irwin Canal Farm, Mandya, Mysore. By M. Subbaiya. *J. Mysore Agric. Exp. Un.*, 1939, **17**, 169-178.

Sugar Refining Costs. Relative Merits of Vegetable Carbon and Bone Char Processes. By L. Wickenden and S. W. Anderson. *Food Industr.*, 1939, **11**, 319-321.

The Economical Combustion of Bagasse. By A. F. Shillington. *Int. Sug. J.*, 1939, **41**, 258-261.

Root Crops

Fertilizer Placement for Potatoes. By G. A. Cumings and G. V. C. Houghland. *Tech. Bull. No.* 669, *U.S. Dep. Agric.* Pp. 48, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 20 cents.

Longevity of Onion Seed in relation to Storage Conditions. By J. H. Beattie and V. R. Boswell. *Circ. No.* 512, *U.S. Dep. Agric.* Pp. 23, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

The Control of Onion Fly (*Delia* [*Hylemyia*] *antiqua* Meig.) By D. W. Wright. *J. Minist. Agric.*, 1939, **46**, 147-154.

L'Industrie du Manioc à la Martinique. *Cah. Colon., Marseille*, 1939, No. 790, 133-135.

Fruits

Annual Report of the University of Bristol Fruit and Vegetable Preservation Research Station, Campden, for 1938. Pp. 79, 9¾ × 6. (Campden, Glos : Fruit and Vegetable Preservation Research Station, 1939.)

Annual Report of University of Bristol Agricultural and Horticultural Research Station (The National Fruit and Cider Institute), Long Ashton, Bristol, for 1938. Pp. 295, 9½ × 6. (Long Ashton, Bristol: Agricultural and Horticultural Research Station, 1939.)

Fruit Production: Bush Fruits. *Bull. No.* 4 (*4th Ed.*), *Minist. Agric., Lond.* Pp. 45, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 1*s.* 3*d.*

Regrafting Fruit Trees by Framework Methods. By R. J. Garner. *J. Minist. Agric.*, 1939, **46**, 176-187.

Experiments with Growth Controlling Substances. II. Response of Fruit Tree Cuttings to Treatment with Synthetic Root-forming Substances. By H. L. Pearse. *Rep. E. Malling Res. Sta.*, 1938, 157-166.

Commercial Fruit Tree Spraying. Methods and Costs. By J. Turnbull. *Bull. No.* 5 (*4th Ed.*), *Minist. Agric., Lond.* Pp. 76, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 1*s.* 6*d.*

Storage of Tropical Fruits. By C. W. Wardlaw. *Nature*, 1939, **144**, 178-181.

Banana Storage Investigations 1937-39. By C. W. Wardlaw, E. R. Leonard and H. R. Barnell. *Trop. Agric., Trin.*, 1939, **16**, 130-142. An account of the work carried out at the Low Temperature Research Station, Imperial College of Tropical Agriculture, Trinidad.

Bacterial Rot of Cherry Fruits. By H. Wormald. *Rep. E. Malling Res. Sta.*, 1938, 173-175.

Citrus in the United States. By A. Pascual. *Int. Rev. Agric.*, 1939, **30**, 201T-210T.

Top-working Citrus Trees. By J. C. le Roux. *Frmg. S. Afr.*, 1939, **14**, 173-175.

The Utilisation of Culls in Peace Time and of Large Quantities of Citrus Fruit in Case of War. By D. B. Seginer. *Hadar*, 1939, **12**, 175-177, 184.

The Citrus Snout Beetle. By L. B. Ripley and G. A. Hepburn. *Frmg. S. Afr.*, 1939, **14**, 291. Account of investigations being undertaken on this pest at the Cedara College of Agriculture, Natal.

Some Suggestions for the Control of the Citrus and Mango Fruit Fly (*Dacus ferrugineus*). By J. C. Hutson. *Trop. Agric., Ceylon*, 1939, **92**, 281-287.

The Citrus Rind Borer (*Prays citri*) and its Control. By C. E. Garcia. *Philipp. J. Agric.*, 1939, **10**, 89-92.

The Chaff Scale (*Parlatoria pergandei* var. *camelliæ* Comst.) By H. Z. Klein. *Hadar*, 1939, **12**, 179-181. Methods of dealing with this pest of citrus.

Relation of Magnesium Deficiency in Grapefruit Leaves to Yield and Chemical Composition of Fruit. By B. R. Fudge. *Bull. No.* 331, *Fla. Agric. Exp. Sta.* Pp. 36, 9 × 6. (Gainesville, Florida: Agricultural Experiment Station, 1939.)

Re-working Fig Trees to More Popular Varieties. By G. W. Beverley. *Agric. Gaz. N.S.W.*, 1939, **50**, 324-328.

Les Caprifiguiers et les Figuiers cultivés en Kabylie. By N. Mauri. *Rev. Bot. Appl.*, 1939, **19**, 359-365. An account of the varieties of figs cultivated in Kabylia, Algeria.

Packing Grapes for Market at Home and Abroad. By J. H. Gregory. *Queensld. Agric. J.*, 1939, **51**, 280-290.

Table Grape and Raisin Production in Cyprus. *Int. Rev. Agric.*, 1939, **30**, 196T. Notes on the varieties of grapes cultivated in the Island.

The Drying of Vine Fruits. By F. S. Oldham. *Agric. Gaz. N.S.W.*, 1939, **50**, 95-97, 146-148, 260-264.

Plate Heat Exchangers for the Processing of Wines. By A. Williams. *Fruit Prod. J.*, 1939, **18**, 294-296, 315.

A New Method in Mango Propagation. By T. Tanaka. *Philipp. J. Agric.*, 1939, **10**, 1-10.

Nuts as Flavours. *Flavours*, 1939, **2**, No. 3, 30-32.

I Sistemi di Piantagione dell'Olivo nella Tunisia del Nord. By C. Chabrolin. *Agricoltura Libica*, 1939, **8**, 293-297. System of planting olives in North Tunisia.

Principali Aspetti e Problemi dell' Olivicoltura Libica. By G. Vivoli. *Agricoltura Colon.*, 1939, **33**, 233-255. An account of olive cultivation in Libia.

Papaw Mosaic Disease. By R. E. D. Baker. *Trop. Agric., Trin.*, 1939, **16**, 159-163. Describes the symptoms, possible causes and control.

The Pili Nut in the Bicol Region. By E. A. Lanuza. *Philipp. J. Agric.*, 1939, **10**, 21-31. Deals with the nuts derived from *Canarium ovatum* and *C. luzonicum* and the industry in this region of the Philippines.

The Peach Enterprise in Western New York. Soil Relationships, Costs and Returns, and Marketing. By H. F. DeGraff. *Bull. No.* 710, *Cornell Agric. Exp. Sta.* Pp. 37, 9 × 6. (Ithaca, New York: Cornell University Agricultural Experiment Station, 1939.)

Studies on the Physiological Changes in Peaches during Handling and Railroad-shipment. By K. Matsumoto. *Mem. No.* 46, 1939, *Coll. Agric. Kyoto.* Pp. 79, 10 × 7. (Kyoto, Japan: Imperial University, 1939.)

The Oriental Peach Moth (*Cydia molesta* Busck.). Investigations in the Goulburn Valley, Victoria. Progress Report for the Seasons 1935-38. By G. A. H. Helson. *Pamphl. No.* 88, *Coun. Sci. Industr. Res. Aust.* Pp. 23, 9½ × 6. (Melbourne: Government Printer, 1939.)

The Removal of Arsenic. The Effect of Different Methods of Keeping Quality of Bon Chretien Pears. By J. Reyneke. *Frmg. S. Afr.*, 1939, **14**, 233-236. Describes an investigation undertaken for the purpose of determining to what extent the recommended washing methods for removing arsenical spray residues are responsible for the poor keeping qualities of these pears.

Pineapple Wilt in Mauritius. By W. F. Jepson and P. O. Wiehe. *Bull. No.* 47, *Gen. Series, Dep. Agric. Mauritius.* Pp. 16, 9¾ × 6¼. (Port Louis: Government Printer, 1939.) Price 25 cents.

Wood Wool for Pineapple Packing. By C. J. J. Watson. *Queensld. Agric. J.*, 1939, **51**, 401-402.

Remarques sur les Améliorations à Apporter à la Culture du Pistachier. By F. Scarone. *Rev. Bot. Appl.*, 1939, **19**, 415-420. Notes on improvements which could be effected in the cultivation of the pistachio tree.

Strawberry Culture in Queensland. By H. Barnes. *Queensld. Agric. J.*, 1939, **51**, 291-295.

Handling and Shipping Strawberries without Refrigeration. By D. F. Fisher and J. M. Lutz. *Circ. No.* 515, *U.S. Dep. Agric.* Pp. 16, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Tomato Culture. By B. P. Krone. *J. Dep. Agric. Vict.*, 1939, **37**, 271-278.

Studies in Fruit Storage. I. Influence of the Stage of Maturity and Storage Temperature on Respiratory Drifts during the Ripening of Tomato Fruits. By B. N. Singh and P. B. Mathur. *Ann. Appl. Biol.*, 1939, **26**, 203-212.

Control of Tomato Leaf Mildew. Successful Results in Glasshouse Tests. By H. J. Hynes. *Agric. Gaz. N.S.W.*, 1939, **50**, 244-247.

World Developments in Fruit Juice Production. The Present English Industry. By R. C. Morel. *Bottler and Packer*, 1939, **13**, No. 5, 86-91.

Pure Fruit Juices. Their Methods of Manufacture, Chemical Composition and Significance from Nutritional and Medical Points of View. By V. L. S. Charley. *Bottler* and *Packer*, 1939, **13**, No. 5, 64-81.

La Production des Jus de Fruits par les Colonies Françaises. Évolution en France de la Fabrication des Jus de Raisin. By M. Flanzy. *Rev. Bot. Appl.*, 1939, **19**, 354-358.

Unfermented Apple Juices: Effect of Process and Variety on Flavour. By V. L. S. Charley. *Flavours*, 1939, **2**, No. 3, 7-10.

Apple Juice Concentration. *Food*, 1939, **8**, 313-316. An account of the plant at Märuil, Switzerland.

The Carbonation of Cider with Dry Ice. By R. W. Arengo-Jones. *Fruit Prod. J.*, 1939, **18**, 297.

Containers for Fruit and Vegetables. By L. C. Carey. *Frms.' Bull. No.* 1821, *U.S. Dep. Agric.* Pp. 63, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Spices

The Cardamom Hairy Caterpillar (Fam., Eupterotidæ) and its Control in the Mysore State. *Circ. No.* 65, *Dep. Agric. Mysore.* Pp. 4, 9½ × 6. (Bangalore: Superintendent, Government Press, 1939.)

The Influence of Spacing, Ridging and Seedling Number per Hill on the Yields of Chillies (*Capsicum frutescens* L.). By W. R. C. Paul and M. Fernando. *Trop. Agric., Ceylon*, 1939, **92**, 156-162.

Further Manurial and Cultural Experiments on Chillies. By A. W. R. Joachim, G. Harbord and S. K. Thuraisingham. *Trop. Agric., Ceylon*, 1939, **92**, 339-347.

Cost of Producing a Crop of Ginger. By T. Sharpe. *J. Jamaica Agric. Soc.*, 1939, **43**, 145-146.

Vanilla. The Queen of Flavours: Its Production and Commerce. *Chem. and Drugg.*, 1939, **130**, 693-694.

Vegetables

Lettuce Mosaic. By G. C. Ainsworth and L. Ogilvie. *Ann. Appl. Biol.*, 1939, **26**, 279-297.

Mushroom Casing Soil in relation to Yield. By E. B. Lambert and H. Humfeld. *Circ. No.* 509, *U.S. Dep. Agric.* Pp. 11, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Fodders and Forage Plants

Rations for Live Stock. By T. B. Wood and revised by H. E. Woodman. *Bull. No.* 48, (*10th Ed.*) *Minist. Agric., Lond.* Pp. 88, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 1*s.* 3*d.*

Home-grown Feeding Stuffs. By H. E. Woodman. *Bull. No.* 13 (*3rd Ed.*) *Minist. Agric., Lond.* Pp. 81, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 1*s.*

The Management and Utilisation of Natural Pastures. By H. C. Arnold. *Rhod. Agric. J.*, 1939, **36**, 376-391.

Survey of Tussock-grasslands of the South Island, New Zealand. Preliminary Report. By V. D. Zotov. *Bull. No.* 73, *Dep. Sci. Industr. Res. N.Z.* Pp. 32, 9¾ × 6. (Wellington, N.Z.: Government Printer, 1939.)

Temperature and other Factors affecting the Germination of Fescue Seed. By V. Kearns and E. H. Toole. *Tech. Bull. No.* 638, *U.S. Dep. Agric.* Pp. 35, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Relation of Temperature and Moisture Content to Longevity of Chewings Fescue Seed (*Festuca rubra* var. *commutata* Gaud.). By V. Kearns and E. H. Toole. *Tech. Bull. No.* 670, *U.S. Dep. Agric.* Pp. 27, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Recherches sur les Espèces du Genre Cyamopsis, Plantes Fourragères pour les Pays Tropicaux et Semi-arides. By A. Chevalier. *Rev. Bot. Appl.*, 1939, **19**, 242-249.

The Effect of Intensity and Frequency of Clipping on Density and Yield of Black Grama (*Bouteloua eriopoda*) and Tobosa Grass (*Hilaria mutica*). By R. C. Canfield. *Tech. Bull. No.* 681, *U.S. Dep. Agric.* Pp. 32, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Perennial Ryegrass: Seed Production of Bred Strains. By G. Evans. *J. Minist. Agric.*, 1939, **46**, 355-362.

Some Effects of Temperature on the Growth and Chemical Composition of Certain Pasture Grasses. By E. M. Brown. *Res. Bull. No.* 299, *Mo. Agric. Exp. Sta.* Pp. 76, 9 × 6. (Columbia, Missouri: Agricultural Experiment Station, 1939.)

Comparative Trials at Mpwapwa with Leguminous Crops of Value in Feeding Livestock. By M. H. French. *E. Afr. Agric. J.*, 1939, **4**, 457-462.

The Vitamin G Content of Some Oil Press-cake Meals and related Products. By F. W. Sherwood and J. O. Halverson. *J. Agric. Res.*, 1939, **58**, 787-794.

Essais sur la Préparation de l'Ensilage en Meules Découvertes. *Bull. Direct. Affaires Econ., Tunis*, 1939, **43**, 33-52.

Le Tourteau de Sésame et sa Valeur Nutritive. *Agron. Colon.*, 1938, **28**, 115-118.

Oils and Oil Seeds

Studies of Principal Agricultural Products on the World Market. No. 4. Oils and Fats: Production and International Trade. Part I. Pp. 345, 9½ × 6¾. (Rome: International Institute of Agriculture, 1939.) Price 25 lire. Deals with fats and oils of vegetable origin in

three sections, viz., products of herbaceous crops, products of tree crops, and trends of world production of and trade in oleaginous vegetal raw materials and their products.

Studies of Principal Agricultural Products on the World Markets. No. 5. Oils and Fats: Production and International Trade. Part II. Pp. 423 + 12 graphs, 9½ × 6¾. (Rome: International Institute of Agriculture, 1939.) Price 25 lire. Deals with fats and oils of animal origin (land and marine animals) and contains a general survey of the production and consumption of fats and oils in certain large importing countries and general information on the use of the products, and prices.

World Supply of Fats and Oils. By H. Böker. *Int. Rev. Agric.*, 1939, **30**, 243E-271E.

Castor Seed. *Ceylon Tr. J.*, 1939, **4**, 109-111.

Some Newer Uses of Castor Oil. By I. Taussky. *Mfg. Chem.*, 1939, **10**, 189-190.

Ceylon's Coconut Crops. By R. Child. *Trop. Agric., Ceylon*, 1939, **92**, 330-335. Statistics relating to coconut products in Ceylon.

Annual Reports of the Soil Chemist, Coconut Research Scheme, Ceylon, for the period July 1933 to December 1937. Pp. 76, 9¾ × 7¼. (Lunuwila: Coconut Research Scheme, 1938.)

L'Amélioration des Semences d'Arachide au Sénégal. By A. Hacquart. *Bull. Agric. Congo Belge*, 1939, **30**, 106-125.

Notes sur Deux Conditions Pathologiques de l'*Elaeis guineensis*. By R. L. Steyaert. *Publ. No.* 18, 1939, *Sci. Sér., Inst. Nat. Étude Agron. Congo Belge*. Pp. 13, 9½ × 6½. (Brussels: Institut National pour l'Étude Agronomique du Congo Belge, 1939.) Price fr. 4. Notes on two pathological conditions causing damage to oil palms.

Décoloration de l'Huile de Palme. By G. de Belsunce. *Bull. Inst. Colon. Marseille Mat. Grasses*, 1939, No. 4, 79-85.

Het Sterilisatieproces in het Palmoliebedrijf. By E. W. Bokhorst. *Ind. Mercuur*, 1939, **62**, 213-214.

La Coltivazione dello Zafferanone (*Carthamus tinctorius*). By E. Morgagni. *Agricoltura Colon.*, 1939, **33**, 301-308. The growing of safflower, with special reference to Abyssinia.

The Soya Bean. *J. Dep. Agric., Eire*, 1939, **36**, 73-79. Gives an account of experiments carried out with the soya bean in Ireland over a period of years.

Balanced Incomplete Block and Lattice Square Designs for Testing Yield Differences among Large Numbers of Soybean Varieties. By M. G. Weiss and G. M. Cox. *Res. Bull. No.* 257, *Iowa Agric. Exp. Sta.* Pp. 24, 9 × 6. (Ames, Iowa: Agricultural Experiment Station, 1939.)

Les Applications du Soja en Europe. *Matières Grasses*, 1939, **31**, 149-150. Notes on the products made from soya beans.

De Tungoliecultuur in Nederlandsch-Indië. *Bergcultures*, 1939, **13**, 614-615.

A Survey of Tung Groves in New Zealand. By M. M. Burns, N. H. Taylor, J. K. Dixon and L. Hodgson. *Bull. No.* 66, *Dep. Sci. Industr. Res. N.Z.* Pp. 61, 9¾ × 6. (Wellington, N.Z.: Government Printer, 1939.)

British Standard Specification for Whale Oil. *Brit. Stand. Inst. No.* 836. Pp. 12, 8½ × 5½. (London: British Standards Institution, 1939.) Price 2*s.* 2*d.*

L'Industria della Cera d'Api. *Riv. Ital. Essenze*, 1938, **20**, 448-450; 1939, **21**, 43-44. An account of the production and purification of beeswax.

Essential Oils

Germination of Clove Seeds. By V. K. Badami. *Leafl., Dep. Agric. Mysore.* Pp. 5 + 5 plates, 9½ × 6. (Bangalore: Department of Agriculture, 1938.)

Eriocephalus africanus Concrete Otto (Preliminary Communication). By L. Trabaud and S. Sabetay. *Perfum. Essent. Oil Rec.*, 1939, **30**, 171-172. An account of the extraction of the perfume substance of the plant and the characteristics of the otto.

Le Essenze di *Eucalyptus globulus* Labill. dell' A.O.I. *Riv. Ital. Essenze*, 1939, **21**, 226-231. An account of the possibilities of the production of eucalyptus oil in Italian East Africa, specially Abyssinia.

Distribution géographique des Lavandes. By J. Gattefossé. *Parfum. Mod.*, 1939, **33**, 107-118.

Constituents of the Essential Oil of Matai (*Podocarpus spicatus*). By J. M. Butler and J. T. Holloway. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 223-225. Deals with the oil from the leaves of this New Zealand tree.

Sulle Essenze di Alcune Rose Spontanee e Coltivate dell' Impero. By P. Rovesti. *Riv. Ital. Essenze*, 1939, **21**, 111-116. An account of some wild and cultivated roses and their essential oils in the Italian colonies.

Algerian Rue Oils. Recent Researches. By Y. R. Naves. *Perfum. Essent. Oil Rec.*, 1939, **30**, 93-95. A study of the oils from *Ruta* spp.

La Sarriette des Montagnes (*Satureia montana* L.). By M. G. Igolen and D. Sontag. *Rev. Marques Parfums de Fr.*, 1939, **17**, 109-111. Deals with the cultivation of the plant, and the composition and characteristics of the essential oil.

Fibres

Microscopic Methods used in Identifying Commercial Fibres. By T. M. Plitt. *Circ. No. C423, U.S. Bur. Stand.* Pp. 26, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Seed Flax in Eastern Washington. By O. E. Barbee and E. G. Shafer. *Bull. No. 370, Wash. Agric. Exp. Sta.* Pp. 16, 9 × 6. (Pullman, Washington: Agricultural Experiment Station, 1939.)

The Warm Water Tank Retting of Linen Flax. By A. M. Munro. *J. Coun. Sci. Industr. Res., Aust.*, 1939, **12**, 97-103.

Het Begrijp "Java-kapok" van de Nederlandsche Warenwet. By W. Spoon and W. M. Sesseler. *Ber. No. 136, HandMus. Kolon. Inst. Amst.* Pp. 12, 8½ × 5½. (Amsterdam: Koloniaal Instituut, 1939.) The legal interpretation in Holland of the term "Java kapok." With summary in English.

General Report for the period July 1, 1937, to December 31, 1938, on Sisal Research conducted at the Linen Industry Research Institute Lambeg, Northern Ireland. By W. H. Gibson. Pp. 14, 9¾ × 6. (Lambeg, Northern Ireland: Linen Industry Research Institute, 1939.)

Considerations on the Fibre Agaves. By C. A. Gehlsen. *Int. Rev. Agric.*, 1939, **30**, 204E-228E. A review of the production, trade and utilisation of hard fibres derived from Agaves, their methods of cultivation, extraction, grading, etc.

The Utilisation of Sisal Waste in Java and Sumatra. By J. E. A. den Doop. *E. Afr. Agric. J.*, 1938, **3**, 423-438; **4**, 89-99, 343-351, 415-425.

World Consumption of Wool 1938. *Publication of the Imperial Economic Committee.* Pp. 140, 13 × 8¼. (London: H.M. Stationery Office, 1939.) Price 2*s.* 11*d.*

Rugging of Flock Sheep. Marked Improvement in Wool indicates Scope for Extension of Practice. *N.Z. J. Agric.*, 1939, **58**, 315-324. Results of some further trials carried out in New Zealand.

Machine Shearing for Profitable Wool Production. By D. Murray. *J. Minist. Agric.*, 1939, **19**, 258-264.

Sheep Rugging in Australia. By W. F. McQuin. *J. Minist. Agric.*, 1939, **46**, 136-139.

Sheep and Wool. By J. Carew. *Queensld. Agric. J.*, 1939, **51**, 362-380. An account of the Queensland wool industry.

The Trend of Progress in the Cellulosic Textile Industry. By H. A. Thomas. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 617-625.

Casein Fibre. By E. O. Whittier and S. P. Gould. *Industr. Engng. Chem., News Ed.*, 1939, **17**, 369-370.

Paper-making Materials

The Trend of Progress in the Cellulose Industry, with Special Reference to the Paper and Allied Industries. By J. Grant. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 613-617.

Pulp from Coconut Husk. *World's Paper Tr. Rev.*, 1939, **3**, 1632-1634. Gives particulars of a Ceylon patent for the process.

Fiber Composition of Paper. *Paper Tr. J.*, 1939, **108**, No. 23, 31-40. This method covers the identification of the types of fibres present in a sample of paper and their quantitative estimation and is a revised tentative standard of the Technical Association of the Pulp and Paper Industry of the U.S.

Gas Chlorination in Cellulose Manufacture. By U. Pomilio. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 657-662. An account of the Pomilio process.

Bibliography of Pulp and Paper-making and United States Patents, 1938. Compiled by C. J. West. Pp. 248, 9 × 6. (New York: Technical Association of the Pulp and Paper Industry, 1939.)

Rubber

De Heveacultuur in Belgisch-Congo. By A. Ringoet. *Bull. Agric. Congo Belge*, 1939, **30**, 130-134.

The Sungei Pendas Method of Replanting. Success of System of Intensive Cultivation. *Planter, Malaya*, 1939, **20**, 132-134.

Verdere Resultaten der Heveaselectie in West Java. By M. J. Dijkman. *Bergcultures*, 1939, **13**, 492-503. Discusses further results obtained in rubber selection.

Helicobasidium compactum Boedijn als Parasitaire Wortelschimmel van *Hevea brasiliensis*. By H. J. de Fluiter. *Bergcultures*, 1939, **13**, 392-398. A disease of rubber caused by the fungus attacking the roots of the tree.

Rubber Equipment in Modern Farm Management. By D. N. McHardy. *Bull. No.* 11, *Rubb. and Agric. Serv., Brit. Rubb. Publ. Assoc.* Pp. 21, 8½ × 5½. (London: The British Rubber Publicity Association, 1939.)

Tobacco

Report on the Marketing of Tobacco in India and Burma. Pp. 503, 9¾ × 6½. (Delhi: Manager of Publications, 1939.) Price Re. 1 As. 4.

The Tobacco Marketing Problem in Australia. By R. E. Courthorpe-Giles. *J. Dep. Agric. S. Aust.*, 1939, **42**, 700-703.

Grading and Marketing of Tobacco Leaf. By A. Sharp. *J. Dep. Agric. W. Aust.*, 1939, **16**, 50-53.

Cigar Filler Leaf Tobacco Culture in the Philippines. By D. B. Paguirigan. *Philipp. J. Agric.*, 1939, **10,** 81-85.

The Tobacco Industry in Puerto Rico. By C. E. Gage. *Circ. No.* 519, *U.S. Dep. Agric.* Pp. 54, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Entomological Investigations on the Leaf-curl Disease of Tobacco in Northern India. III. The Transmission of Leaf-curl by White-fly, *Bemisia gossypiperda*, to Tobacco, Sann Hemp and a new Alternate Host of the Leaf-curl Virus. By Hem Singh Pruthi and C. K. Samuel. *Indian J. Agric. Sci.*, 1939, **9,** 223-275.

Soil Studies on the Causes of the Brown Root Rot of Tobacco. By E. D. Matthews, C. A. Reneger and R. P. Thomas. *J. Agric. Res.*, 1939, **58,** 673-684.

Studies on the Nature of Brown Root Rot of Tobacco and other Plants. By J. Johnson. *J. Agric. Res.*, 1939, **58,** 843-863.

Downy Mildew (Blue Mold) of Tobacco. By R. R. Kincaid and W. B. Tisdale. *Bull. No.* 330, *Fla. Agric. Exp. Sta.* Pp. 28, 9 × 6. (Gainesville, Florida: Agricultural Experiment Station, 1939.)

Drugs

Seventy-sixth Annual Report of the Government Cinchona Plantations and Factory in Bengal for the year 1937-38. Pp. 30, 9¾ × 6½. (Alipore, Bengal: Superintendent, Government Printing, 1938.) Price As. 5.

Contributo allo Studio sulle Possibilità di Coltivazione delle *Cinchona succirubra* Pav. nell' A.O.I. By F. Cappelletti and P. Rovesti. *Riv. Ital. Essenze*, 1938, **20,** 382-394, 416-422; 1939, **21,** 3-12. An account of the possibilities of the cultivation of Cinchona in Italian East Africa.

Essais d'Acclimatation des Arbres à Quinquina en Indochine. By A. Yersin. *Rev. Bot. Appl.*, 1939, **19,** 237-242.

Extraction of Saponin from Soap Nut. By J. L. Sarin and M. L. Beri. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31,** 712-713.

Harmine, the Alkaloid of Caapi. By A. L. Chen and K. K. Chen. *Quart. J. Pharm.*, 1939, **12,** 30-38. An account of the alkaloid derived from *Banisteria caapi*, a woody climber of South America.

Miscellaneous Agricultural Products

Effect of Temperature of Digestion, Chemical Composition, and Size of Particles on Production of Fuel Gas from Farm Wastes. By G. H. Nelson, R. P. Straka and M. Levine. *J. Agric. Res.*, 1939, **58,** 273-287.

The Quantitative Extraction of Carotene from Grass. By F. E. Moon. *J. Agric. Sci.*, 1939, **29,** 295-301.

Cork and Cork Products. The History, Source, Properties and Uses of Cork Wood. By G. B. Cooke. *Bottler and Packer*, 1939, **13,** 66-68.

Un Carburant National Économique pour l'A.O.F. L'Alcool de Sisal. By J. Brémond-Renoux. *Bull. Inst. Colon. Havre*, 1939, **11,** N. 114, 11-22. A review of the position of sisal in French West Africa and an account of the production of alcohol at Diakandape-Same, with a discussion on the future of alcohol from sisal.

Cellulosic Agricultural By-Products. By D. F. J. Lynch. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31,** 149-153.

Saccharification of Starchy Grain Mashes for the Alcoholic Fermentation Industry. Use of Mold Amylase. By L. A. Underkofler, E. I. Fulmer and L. Schoene. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31,** 734-738.

Livestock and Animal Products

Annual Report of the Veterinary Department, Uganda, for the year ended December 31, 1938. Pp. 32, 9¾ × 6. (Entebbe: Government Printer, 1939.) Price Sh. 1/50.

Magnesium in Animal Nutrition. By J. Duckworth. *Nutr. Abst. Rev.*, 1939, **8**, 851-860.

Report of Proceedings of the Second Conference of Governors of British East African Territories on Rinderpest held at Nairobi, February 1939. Pp. 52, 9¾ × 6. (Nairobi: Government Printer, 1939.)

Livestock Diseases Report (No. 14). Recording Control Work carried out by the Department of Agriculture, New South Wales, for the year ending June 30, 1938. Pp. 31, 9½ × 6. (Sydney: Government Printer, 1939.)

Fat Lamb Production in the Union. By D. C. Maree, P. J. Joubert and H. C. Bonsma. *Frmg. S. Afr.*, 1939, **14**, 261-269. Deals with conditions in Natal, the Transvaal and the Karroo Areas.

Raising Sheep on Temporary Pastures. By C. G. Potts and V. L. Simmons. *Frms.' Bull. No.* 1181 (*Revised*), *U.S. Dep. Agric.* Pp. 12, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

The Control of Stomach Worms in Sheep in Eastern Canada. By W. E. Swales. *Publ. No.* 639, *Dep. Agric. Canada.* Pp. 7, 9½ × 6½. (Ottawa: Department of Agriculture, 1939.)

Present Position of the Dairying Industry in the Different Countries. No. 20. Yugoslavia. By E. Gasser. *Int. Rev. Agric.*, 1939, **30**, 183T-195T.

L'Exploitation du Troupeau Laitier. By A. Morin and R. Proulx. *Bull. No.* 138, *Minist. Agric. Québec.* Pp. 83, 9×6. (Quebec: Department of Agriculture, 1939.)

New Developments in Dairy Cattle Breeding in the United States. By S. Taussig. *Int. Rev. Agric.*, 1939, **30**, 174T-182T.

Systems of Dairy Farming. By R. G. White. *J. Minist. Agric.*, 1939, **46**, 372-378.

Meat-meal as a Supplementary Source of Protein for Milking Cows on Pasture. By A. C. T. Hewitt. *Emp. J. Exp. Agric.*, 1939, **7**, 184-192.

Notes on the Contamination of Milk by Bacteria in the Tropics. By S. H. Crowdy. *Trop. Agric., Trin.*, 1939, **16**, 124-129.

Composition and Properties of Goat's Milk as compared with Cow's Milk. By J. A. Gamble, N. R. Ellis and A. K. Besley. *Tech. Bull. No.* 671, *U.S. Dep. Agric.* Pp. 72, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Notes on Circumstances affecting the Quality of Milk. *Adv. Leafl. No.* 29, *Minist. Agric., Lond.* Pp. 3, 8½ × 5½. (London: H.M. Stationery Office, 1939.) Price 1*d.*

Annual Report of the Fisheries Department, Straits Settlements and Federated Malay States for the year 1937. Pp. 43, 9½ × 6. (Singapore: Government Printing Office, 1939.)

The Vitamin-D Potency of Different Fish and Fish Products. By V. Aschehoug, H. Kringstad and G. Lunde. *J. Soc. Chem. Ind., Lond.*, 1939, **58**, 220-223. Deals with herring "sild" and a number of other fish products such as canned cod roe, mackerel liver, red char, dog-fish liver, etc.

The Occurrence and Biological Features of Haddock in the Newfoundland Area. By H. Thompson. *Res. Bull. No.* 6, *Dep. Nat. Resources, Newfdld.* Pp. 31, 9 × 6. (St. John's: Department of Natural Resources, 1939.) Price 20 cents.

Verarbeitung von Fischabfällen auf Fischmehl und Öl. By O. W. Steinmann. *Fette u. Seifen*, 1939, **46**, 192-195. The working up o waste fish for the production of fish meal and oil.

The Poultry Industry in South Africa. By J. J. Jordaan. *Frmg. S. Afr.*, 1939, **14**, 196-197, 210.

The Feeding of Poultry on Wheat and Other Grains. *J. Dep. Agric. W. Aust.*, 1939, **16**, 80-88.

Ducks on the Farm. By H. G. Wheeldon. *Rhod. Agric. J.*, 1939, **36**, 364-375.

Microbiology in the Preservation of the Hen's Egg. By R. B. Haines. *Spec. Rep. No.* 47, *Food Invest. Bd., Lond.* Pp. 65, 9½ × 6. (London : H.M. Stationery Office, 1939.) Price 2*s.* 6*d.*

FORESTRY

General

Field Notes on Some Rain Forests and Rain Forest Trees of Tropical Queensland. By W. D. Francis. *Queensld. Agric. J.*, 1939, **51**, 250-279.

Report of the Forest Department, British Honduras, for the year 1938. Pp. 21, 12½ × 8. (Belize : Government Printer, 1939.)

Report on Forest Administration in the Utilisation Circle, Burma, for the year ended March 31, 1938. Pp. 43, 9¾ × 6½. (Rangoon : Superintendent, Government Printing and Stationery, 1939.) Price Rs. 2.

Annual Report on Working Plans, Silviculture and Entomology, in Burma for 1937-38. Pp. 116, 9½ × 7¼. (Rangoon : Superintendent, Government Printing and Stationery, 1939.) Price Rs. 2.

The Influence of Vegetation on Climate in West Africa with particular reference to the Protective Aspects of Forestry in the Gold Coast. By H. W. Moor. *Pap. No.* 17, *Imp. For. Inst., Oxford.* Pp. 15, 9¾ × 6. (Oxford : Imperial Forestry Institute, 1939.) Price 1*s.*

Forest Research in India, 1937-38. Part 2. Provincial Reports. Pp. 170, 9½ × 7¼. (Delhi : Manager of Publications, 1939.) Price Rs. 2 As. 14.

Report on Forest Administration in the Andamans for the year 1937-38. Pp. 68, 9½ × 6¼. (Delhi : Manager of Publications, 1939.) Price Rs. 7 As. 4.

Report on the Forest Department in the Central Provinces and Berar for the year ending March 31, 1938. Pp. 41, 9¾ × 6¼. (Nagpur, C.P. : Government Printing, 1938.) Price Re. 1 As. 8.

Report of Forest Administration in the Mysore State for the year ending June 30, 1937. Pp. 195, 9¾ × 6. (Bangalore : Superintendent, Government Press, 1938.)

Report on Forest Administration in the Punjab for 1937-38. Pp. 111, 10 × 7. (Lahore : Superintendent, Government Printing, 1938.) Price As. 8.

Annual Administration Report of the Sind Forest Department for the year 1937-38 with Appendices. Pp. 69, 9½ × 6. (Karachi : Manager, Government Book Depot and Record Office, 1939.) Price As. 12.

Annual Report of the Forest Research Institute, Kepong, Forest Department, F.M.S. and S.S. for 1938. Pp. 22, 13 × 8. (Kepong : Forest Research Institute, 1939.) Mimeographed copy.

Annual Report on the Forest Administration of Nigeria for the year 1937. Pp. 46, 13 × 8. (Lagos : Government Printer, 1939.) Price 4*s.*

Annual Report of the Forestry Department, Nyasaland, for the year ended December 31, 1938. Pp. 53, 13 × 8½. (Zomba: Government Printer, 1939.) Price 1*s*.

Annual Report on the Forest Department, Sarawak, for the year 1938. Pp. 13, 13½ × 8½. (Kuching: Government Printer, 1939.)

The Forests of Sweden. By Th. Streyffert. Pp. 72, 8½ × 5¾. (Stockholm: Alb. Bonniers Boktryckeri, 1938.)

Annual Report of the Forest Department, Uganda Protectorate, for the year ended December 31, 1938. Pp. 24, 9¾ × 6. (Entebbe: Government Printer, 1939.)

Eighteenth Annual Report of the Southern Forest Experiment Station for 1938. Pp. 44, 10½ × 8. (New Orleans, La.: Southern Forest Experiment Station, 1939.)

Note sur le Bambou aux Indes Néerlandaises. By M. Maron. *Agron. Colon.*, 1939, **28**, 108-114. Gives an account of the bamboos grown in the Netherlands Indies and their particular uses.

Costs and Returns of Managing 100,000 Acres of Shortleaf and Loblolly Pine for Sustained Yield. By W. E. Bond. *Occ. Pap. No.* 79, *Sth. For. Exp. Sta., New Orleans.* Pp. 15, 10½ × 8. (New Orleans, La.: Southern Forest Experiment Station, 1939.)

Planting Southern Pines. By P. C. Wakeley. *Leafl. No.* 159 (*Revised*), *U.S. Dep. Agric.* Pp. 8, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price 5 cents.

Needle Fusion of *Pinus* in Southern New South Wales. Second Progress Report (1937-38). By W. V. Ludbrook. *Pamphl. No.* 89, *Coun. Sci. Industr. Res. Aust.* Pp. 20, 9½ × 6. (Melbourne: Government Printer, 1939.)

Dipterocarpus (Gurjan) Forests in India and their Regeneration. By J. N. Sen Gupta. *Indian For. Rec.* (*New Ser.*) *Silvic.* **3,** No. 4. Pp. 164, 9½ × 7¼. (Delhi: Manager of Publications, 1939.) Price Rs. 4 As. 14.

The Planting of Tips and Slag Heaps. By N. D. G. James. *Quart. J. For.*, 1939, **33,** 164-172.

Timber

Figure in Timber. *Trade Circ. No.* 43, *For. Prod. Aust.* Pp. 22, 9½ × 6. (Melbourne: Government Printer, 1939.)

Laminated Wood. By W. Nagle. *Leafl. No.* 2, *Woodwkg. Ser., For. Res. Inst., India.* Pp. 7 + 6 plates, 8½ × 5½. (Dehra Dun, India: Forest Research Institute, 1938.)

Drijfvermogen van met Paraffine Geconserveerd Balsa-hout. By W. Spoon and W. M. Sesseler. *Ber. No.* 135, *HandMus. Kolon. Inst. Amst.* Pp. 18, 8½ × 5½. (Amsterdam: Koloniaal Instituut, 1939.) Deals with the buoyancy of balsa wood preserved with paraffin wax. Summary in English.

Strength Tests of Structural Timbers. Part 4. The Development of a Minimum Structural Grade for Redwood (*Pinus sylvestris*). By C. J. Chaplin and E. H. Nevard. *Rec. No.* 28, *For. Prod. Res., Dep. Sci. Industr. Res.* Pp. 12, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 6*d*.

British Standard Method of Test for the Toxicity of Wood Preservatives to Fungi. *Brit. Stand. Inst. No.* 838. Pp. 17, 8½ × 5½. (London: British Standards Institution, 1939.) Price 2*s*. 2*d*.

Een Boktorlarf als Boorder in Levende en Doode Djatiboomen (*Monohammus rusticator* Fab., Fam. Lamiidae.) By L. G. E. Kalshoven. *Tectona*, 1939, **32,** 321-337. With summary in English. A longicorn borer in living and dying teak trees.

Cryptorrhynchus lapathi L. in relation to the Water-mark Disease of the Cricket-bat Willow. By E. Callan. *Ann. Appl. Biol.*, 1939, **26**, 135-137.

Gums and Resins

Contribution to the Study of the Bleaching of Lac. Part II. Factors which Influence the Keeping Quality of Bleached Lac. By N. N. Murty. *Bull. No.* 32, *Indian Lac. Res. Inst.* Pp. 12, 9 × 6. (Namkum, Ranchi: Indian Lac Research Institute, 1939.) Reprinted from *Industr. Engng. Chem.*, 1939, **31**, 235-239.

Seed-lac. Factors which Affect the Flow. By W. H. Gardner, L. Koprowski and N. N. Murty. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 817-818.

Seed-lac. Factors which Affect Bleaching Quality. By N. N. Murty, W. H. Gardner and B. Gross. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 678-680.

Improved Method of Seedlac Manufacture by the Country Process. By A. K. Thakur, T. Bhowmik and H. K. Sen. *Tech. Note. No.* 4, *Indian Lac Res. Inst.* Pp. 3, 9¾ × 7¼. (Namkum, Ranchi: Indian Lac Research Institute, 1939.) Price As. 2.

Gutta-percha and Balata in Submarine Cable Insulation. By J. N. Dean. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 699-704.

Tapping Benguet Pine in the Mountain Province. By L. Aguilar. *Philipp. J. For.*, 1939, **2**, 65-80. An account of experiments carried out in the Philippines on *Pinus insularis* Endl.

Tanning Materials

De Beteekenis van de Cultuur van *Acacia decurrens* in Nederlandsch-*Indië*. By C. Coster. *Tectona*, 1939, **32**, 368-388. Reviews the world production and trade in tanning materials and discusses the importance of *A. decurrens* for the Netherlands Indies.

The Properties of Redunca Wood Extract. By J. R. Blockey, C. H. Spiers and H. G. Beverley. *J. Int. Soc. Leath. Chem.*, 1939, **23**, 245-252. An investigation of the solid tannin extract prepared from the wood *Eucalyptus redunca*, the wandoo tree of Western Australia.

IMPERIAL INSTITUTE

CONSULTATIVE COMMITTEE ON INSECTICIDE MATERIALS OF VEGETABLE ORIGIN

QUARTERLY BIBLIOGRAPHY ON INSECTICIDE MATERIALS OF VEGETABLE ORIGIN, NO. 7

(April to June 1939)

Prepared in collaboration with the Imperial Institute of Entomology and the Department of Insecticides and Fungicides, Rothamsted Experimental Station.

GENERAL

Report of the Chief of the United States Bureau of Entomology and Plant Quarantine, 1938. Includes brief reports of work on insecticidal materials of vegetable origin.

List of Publications of the Insecticide Investigations, Bureau of Entomology and Plant Quarantine, Washington, for the period January 1939 to March 31, 1939, together with a list of U.S. Patents by members of the Division granted during the same period.

Review of United States Patents relating to Pest Control. Vol. 12 (1939), No. 2, No. 3 and No. 4. By R. C. Roark. *Bur. Ent. U.S. Dep. Agric.*

Biological Methods of Testing Insecticides. A Review. By F. Tattersfield. *Ann. Appl. Biol.*, 1939, **26**, No. 2, 365-384.

An Apparatus for Testing and Comparing the Biological Action of Insecticides on Flying Insects and a Method for Sampling the Concentration of the Atomised Insecticide. By C. Potter and K. S. Hocking. *Ann. Appl. Biol.*, 1939, **26**, No. 2, 348-364.

Insect Repellents. A study of comparative repellency by the Sandwich-Bait Method used against confined house flies. By L. R. Kilgore. *Soap*, 1939, **15**, No. 6, 103, 105, 107, 109, 111, 123.

The Injection of Spray Concentrates—a New Procedure for the Application of Insecticides. By K. Groves, J. Marshall and H. Fallscheer. *Bull. No.* 367 (1938) *Wash. Agric. Exp. Sta.* Instead of dispersing the oil-wetted spray material in a spray tank and pumping out the mixture, water only is put in the tank or is taken direct from the hydrant, and a concentrated flowable paste of oil-preferentially wetted insecticide is injected into the intake line of the spray pump so that the ratio of concentrate to water is constant.

Mosquito Control. By D. E. Longworth. *Soap*, 1939, **15**, No. 5, 94-96.

What New Insecticide Laws ? (United States.) A summary of the legislative situation thus far this year as it affects disinfectants and insecticides—a report with comments from the N.A.I.D.M. Legislative Committee. *Soap*, 1939, **15**, No. 6, 100-102, 121.

Insecticide Specifications. The State of Wisconsin issues four new tentative specifications for insecticides and rodenticides. *Soap*, 1939, **15**, No. 4, 113, 115.

Fungicides and Insecticides Sales Reported—Italy. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 25, 410. Figures given for the quantities of nicotine, pyrethrum, rotenone and quassia insecticides sold in 1936, 1937 and 1938.

ALKALOID-CONTAINING MATERIALS

Tobacco Products, including Nicotine and Nicotine Derivatives

The Occurrence of 1-Nicotine in *Asclepias syriaca* L. By L. Marion. *Canad. J. Res.*, 1939, **17**, No. 1, 21-22.

Inheritance of Nicotine and Anabasine in Interspecific Hybrids *Nicotiana rustica* and *N. glauca*. By N. I. Zukov. *Comptes Rendus, Doklady*, 1939, **22**, No. 3, 116-118.

Nicotine and Citric Acid Content in the Progeny of the Allopolyploid Hybrid *N. rustica* × *N. glauca*. By D. Kostoff. *Comptes Rendus, Doklady*, 1939, **22**, No. 3, 121-123.

Studies of the Toxicity of Certain Nitrophenols, Thiocyanates, Naphthalene Derivatives and Organic Bases to the Eggs of some Common Orchard Pests. By H. Shaw and W. Steer. *J. Pomol.*, 1939, **16**, No. 4, 364-388. Includes tests with nicotine. (*R.A.E.*, 1939, **27**, A, Pt. 6, 331.)

Control of Apple Aphids and European Red Mite by Coal Tar Oil and other Materials. By H. N. Worthley and H. M. Steiner. *J. Econ. Ent.*, 1939, **32**, No. 2, 278-285. Includes test with sprays containing nicotine.

Controlling Codling Moth with Nicotine-Bentonite. By J. M. Merritt. *Ann. Rep. Ent. Soc. Ontario*, 1937, 26-27.

Substitute Spray Materials. By S. A. Vinson and S. A. McCory. *Res. Bull. No.* 292 (1938), *Mo. Agric. Exp. Sta.* Nicotine sulphate-bentonite spray gives good control for codling moth.

Experiments with Nicotine for the Control of Codling Moth. By B. F. Driggers and W. J. O'Neill. *J. Econ. Ent.*, 1939, **32**, No. 2, 286-290.

Effect of Copper Fungicides on Lead-Arsenate-Lime and Fixed Nicotine-Oil Sprays for Codling Moth. By L. A. Stearne, K. J. Kadow and M. W. Goodwin. *J. Econ. Ent.*, 1939, **32**, No. 2, 270-273.

The Tarnished Plant Bug (*Lygus pratensis*) as an Apple Pest. By O. H. Hammer. *J. Econ. Ent.*, 1939, **32**, No. 2, 259-264. Includes tests with dust containing nicotine.

Psylla costalis Flor., ein neuer Blattsauger an Unseren Apfelbäumen. (*P. costalis*, a new Leaf Sucker of Apple in Switzerland.) By R. Wiesmann. *Schweiz. Z. Obst. u. Weinb.*, 1938, **47**, Nos. 15-16, 291-294, 311-314. (*R.A.E.*, 1939, **27**, A, Pt. 5, 232.) Reference made to use of nicotine for the control of the pest.

Suggestions for Control of Strawberry Aphis. By R. M. Greenslade and A. M. Massee. *Ann. Rept. E. Malling Res. Sta., Kent*, 1938, 250-252. Includes use of nicotine sprays.

The Control of Strawberry Aphis and Tarsonemid Mite. By R. M. Greenslade and A. M. Massee. *Ann. Rept. E. Malling Res. Sta., Kent*, 1938, 186-190. Use of nicotine sprays.

The Glasshouse Leaf-hopper *Erythroneura pallidifrons* Edw. By G. E. Wilson. *J. Roy. Hort. Soc.*, 1938, **63**, Pt. 10, 481-484. (*R.A.E.*, 1939, **27**, A, Pt. 3, 115.) Use of nicotine dust.

Micromyzus oliveri Essig as a Greenhouse Pest. By C. F. Doucette. *J. Econ. Ent.*, 1939, **32**, No. 2, 342-343. Use of nicotine sulphate.

Sugar Beet Pests. By F. R. Petherbridge. Proceedings of the Association of Applied Biologists. *Ann. Appl. Biol.*, 1939, **26**, No. 2, 397-399. Includes note on control of black bean aphis (*Aphis* (*Doralis*) *fabae* L.) with nicotine dust.

Controlling the Pea Aphid with Vaporised Nicotine. By J. F. Alsterlund. *Ann. Rept. Ent. Soc. Ontario*, 1937, 43-44.

Lygus Bugs in Relation to Alfalfa Seed Production. By C. J. Sorenson. *Bull.* 284, *Utah Agric. Exp. Sta.* Use of nicotine sulphate dust for control.

Economics of Field-scale Spraying against the White-fly of Cotton (*Bemisia gossypiperda* M. & L.). By M. Afzal Husain, Kidar Nath Trehan and Piare Mohan Verma. *Indian J. Agric. Sci.*, 1939, **9**, Pt. 1, 109-126. Includes tests with tobacco extract.

The Yellow-headed Spruce Sawfly (*Pikonema alaskensis*) in Maine. By R. W. Nash. *J. Econ. Ent.*, 1939, **32**, No. 2, 330-334. Use of nicotine sulphate for control.

De Bestrijding van Kwade Koppen in Vlas. (The control of " bad heads " in flax.) By A. Ovinge. *Tijdschr. PlZiekt.*, 1938, **44**, Pt. 6, 297-304. (*R.A.E.*, 1939, **27**, A, Pt. 5, 233.) Use of nicotine sprays.

On the Study of Pests attacking Non-alkaloid Lupin. By A. Sugak. *Plant. Pro.*, 1938, No. 16, 96-99. (*R.A.E.*, 1939, **27**, A, Pt. 3, 150-151.) Use of sprays containing nicotine sulphate.

The Effect of Tobacco Licks used for the Prevention of Trichostrongylosis in Sheep. By H. McL. Gordon. *J. Coun. Sci. Industr. Res. Aust.*, 1939, **12**, No 2, 104-108

New Company to Manufacture Sulphate of Nicotine in Chosen. *Tobacco Markets, U.S. Dep. Comm.*, 1939, **14**, No. 22, 277. Brief note.

Nicotine Manufacture in the Far East. *Chem. Trade* J., 1939, **104**

No. 2713, 480. Brief note of proposed factory for manufacturing nicotine sulphate in Korea.

Anabasine

Inheritance of Nicotine and Anabasine in Interspecific Hybrids *Nicotiana rustica* and *N. glauca*. By N. I. Zukov. *Comptes Rendus, Doklady*, 1939, **22**, No. 3, 116-118.

Alkaloids of *Salsola richteri*. IV. Salsolidine. By N. Proskurnina and A. Orekhov. *Brit. Chem. Abstr.*, 1939, April, A, II, 190. Abstract of paper in *Bull. Soc. Chim.*, 1939, **6**, 144-146.

On the Study of Pests Attacking Non-alkaloid Lupin. By A. Sugak. *Plant. Pro.*, 1938, No. 16, 96-99. (*R.A.E.*, 1939, **27**, A, Pt. 3, 150-151.) Use of sprays containing anabasine sulphate.

INSECTICIDE MATERIALS CONTAINING ROTENONE AND ALLIED SUBSTANCES

General

Forest Research in India, 1937-38, Pt I, 71-73. Notes on the work with rotenone containing plants.

Rotenone in and Piscicidal Power of Plants of the French Sudan. By O. Gaudin and R. Vacherat. *Br. Chem. Abstr.*, 1939, February, A, III, 218. Abstract of paper in *Bull. Sci. Pharmacol.*, 1938, **40**, 385-394.

Isolement de faibles Quantités de Roténone des Graines Oléagineuses. By F. Guichard. *Ann. Méd. Pharm. Colon.*, 1938, **36**, No. 4, 974-976. (*R.A.E.*, 1939, **27**, A, Pt. 7, 347.)

Insect Pests and Diseases of Strawberry in Oregon. By W. D. Edwards and S. M. Zeller. *Sta. Bull.* 357 (1938), *Oregon State Agric. Exp. Sta.* Notes on the control of spittle bugs by rotenone dusts.

Observations sur la Pyrale Dorée, Ravageur de la Menthe Cultivée au Maroc (*Pyrausta aurata meridionalis* Stgr.) By P. Brémond and C. Rungs. *Rev. Path. Veg.*, 1938, **25**, fasc. 3, 190-194. (*R.A.E.*, 1939, **27**, A, Pt. 4, 193.) Relates to the use of rotenone for controlling the pest.

U.S.A. Rotenone-bearing Products Imports. *Chem. and Drugg.*, 1939, **130**, No. 3084, 314. Figures of imports of derris and cube for 1936, 1937 and 1938, showing countries.

Derris

The History of the Use of Derris as an Insecticide. Part II, The Period 1919-1928. *Publ. E.*-468, *Div. Insect. Invest., Bur. Ent., U.S. Dep. Agric.* Pp. 77.

Beknopt overzicht van de ondernemingscultures in het rayon Zuid-Sumatra gedurende 1938. By G. A. Heudel. *Bergcultures*, 1939, No. 23, 782. Brief note on selection work with derris in South Sumatra.

The Granja Sugar Cane Experiment Station. By J. B. Cabanos. *Philipp. J. Agric.*, 1939, **10**, No. 1, 58. Includes short note on experiments with derris cultivation.

Report of the Puerto Rico Experiment Station, 1937. Includes report on cultivation experiments with *Derris* spp.

Insect Pests on Derris. By R. C. Roark. *J. Econ. Ent.*, 1939, **32**, No. 2, 305-309.

Derris Stability. Effect of temperature and light upon the decomposition of derris. By R. D. Chisholm. *Soap*, 1939, **15**, No. 5.

Fish Poison Plants. Forest Research in India, 1937-38, Pt. 1, pp.

71-73. Brief notes relating to chemical work on a number of plants including species of *Derris*, *Milletia* and *Tephrosia*.

Extract of Derris. By A. Diakonoff and C. M. L. Smulders. *Soap*, 1939, **15**, No. 4, 111. Abstract of a paper in *Pharm. Weekblad*, 1938, **75**, 1097-1107.

Derris of High Rotenone Content. By H. A. Jones. *J. Econ. Ent.*, 1939, **32**, No. 2, 344.

The Approximate Determination of Rotenone in Derris. By R. S. Cahn and J. J. Boam. *J. Soc. Chem. Ind. Lond.*, 1939, **58**, No. 5, 194-196.

Variations in Toxic Content of Roots of *Derris malaccensis* var. *sarawakensis* with Increase in Age of Plants. By C. D. V. Georgi and Gunn Lay Teik. *Malay. Agric. J.*, 1939, **27**, No. 4, 134-140.

The Active Principles of Leguminous Fish-poison Plants. Part 1. The Properties of 1-*a*-Toxicarol isolated from *Derris malaccensis* (Kinta Type). By S. H. Harper. *J. Chem. Soc.*, 1939, May, 812-816.

New Constituents of Derris Root. I. By T. M. Meyer and D. R. Koolhaas. *Analyst*, 1939, **64**, No. 757, 295-296. Abstract of a paper in *Rec. Trav. Chim. Pays-Bas*, 1939, **58**, 207-217.

Proeven over de Werkzaamheid van Derris-stuifmiddelen. *Afd. Handelsmus. No.* 20, *Med. No. XLIX*, *Kon. Vereen. Kol. Inst.*, *Amst.*, 66-72. Relative values of derris and lonchocarpus powders and dusts impregnated with extracts.

Control of the Flat-headed Apple Tree Borer in Oklahoma. By G. V. Johnson and F. A. Fenton. *J. Econ. Ent.*, 1939, **32**, No. 1, 134-142. Includes tests with derris.

Untersuchungen zur Bekämpfung des Apfelblütenstechers (*Anthonomus pomorum* L.). (Investigations on the control of the apple blossom weevil.) By H. Theim. *Forschungsdienst*, 1938, **6**, Pt. 12, 597. (*R.A.E.*, 1939, **27**, A, Pt. 6, 298.) Includes use of derris.

Derris ter Bestrijding van de Rupsenplaag in Amsterdam. (Derris to control the caterpillar pest in Amsterdam.) *Afd. Handelsmus. No.* 20, *Med. No. XLIX*, *Kon. Vereen. Kol. Inst.*, *Amst.*, pp. 72-77.

De Bestrijding van Kwade Koppen in Vlas. (The control of "bad heads" in flax.) By A. Ovinge. *Tijdschr. PlZiekt.*, 1938, **44**, Pt. 6, 297-304. (*R.A.E* 1939, **27**, A, Pt. 5, 233.) Use of derris sprays.

Iets over de Bestrijding van *Thrips lini* (Ladurean) Doeksen, met Derris sproeimiddelen. (A note on the control of *T. lini* with derris sprays.) By J. Doeksen. *Tijdschr. PlZiekt.*, 1938, **44**, Pt. 6, 305-306. (*R.A.E.*, 1939, **27**, A, Pt. 5, 234.)

Further Notes on the Control of the Harlequin Bug. By H. G. Walker and L. D. Anderson. *J. Econ. Ent.*, 1939, **32**, No. 2, 225-228. Includes the use of derris sprays.

The Invermay Bug (*Nysius tnrneri*). By J. W. Evans. *Tasm. J. Agric.*, 1938, **9**, No. 4, 196-198. (*R.A.E.*, 1939, **27**, A, Pt. 5, 226.) Use of derris to give temporary protection.

Further Investigations with Japanese Beetle Repellents. By H. G. Guy and H. F. Dietz. *J. Econ. Ent.*, 1939, **32**, No. 2, 248-252. Includes tests with derris.

Japanese Beetle Control Tests on American Elm Trees in Delaware. *J. Econ. Ent.*, 1939, **32**, No. 2, 253-255. Includes tests with derris.

The Mexican Bean Beetle and its Control in Missouri. By L. Haseman and C. W. Wings. *Circ.* 199, *Univ. Missouri Agric. Exp. Sta.* Brief reference to use of derris.

Pyrethrum and Derris as a Control for the Six-Spotted Leafhopper, a Vector of Lettuce Yellows. By B. B. Pepper and C. M. Haenseler. *J. Econ. Ent.*, 1939, **32**, No. 2, 291-296.

The Ticks of Domestic Animals in Britain. By J. MacLeod. *Emp.*

J. Exp. Agric., 1939, **7**, No. 26, 97-110. Reference to the use of derris for controlling this pest.

The Warble Fly. *Leather World*, 1939, **31**, No. 17, 395-396. Relates to the position in the United Kingdom as regards dressing of cattle with derris.

Aflevering van Derriswortel. *Afd. Handelsmus. No.* 20, *Med. No. XLIX, Kon. Vereen. Kol. Inst., Amsterdam*, pp. 62-64. Deals with form in which derris is marketed.

Derriscultuur in Ned. Indie. *Afd. Handelsmus. No.* 20, *Med. No. XLIX, Kon. Vereen. Kol. Inst., Amsterdam*, pp. 59-62. Gives figures of production and comparative figures of production in other countries and also figures of exports of lonchocarpus from Brazil and Peru.

Lonchocarpus

Report of the Puerto Rico Experiment Station, 1937. Includes report on cultivation experiments with *Lonchocarpus* spp.

Proeven over de Werkzaamheid van Derris-stuffmiddelen. *Afd. Handelsmus. No.* 20, *Med. No. XLIX Kon. Vereen. Kol. Inst., Amst.*, pp. 66-72. Relative values of derris and lonchocarpus powders and dusts impregnated with extracts.

Insecticide Tests for the Control of the Bollworm in 1936. By R. W. Moreland and J. C. Gaines. *J. Econ. Ent.*, 1939, **32**, No. 1, 104-106. Use of cube in conjunction with calcium arsenate.

Further Notes on the Control of the Harlequin Bug. By H. G. Walker and L. D. Anderson. *J. Econ. Ent.*, 1939, **32**, No. 2, 225-228. Includes the use of cube sprays.

Further Investigations with Japanese Beetle Repellents. By H. G. Guy and H. F. Dietz. *J. Econ. Ent.*, 1939, **32**, No. 2, 248-252. Includes tests with cube.

Control of Ox Warbles. Effect of various drugs on the larva of *Hypoderma bovis*. *Vet. Bull.*, 1939, **9**, No. 7, 475. Brief abstract of a thesis by F. Carlier. Includes use of extracts of timbo.

Barbasco Root Exports. *Chem. and Drugg.*, 1939, **130**, No. 3084, 314. Gives exports from Peru in 1937.

Cube Exports Increased—Peru. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 13, 206. Exports for 1936, 1937 and 10 months of 1938.

Insecticide Production Envisaged—Venezuela. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 24, 392. Brief note on proposed development of barbasco.

Others

Report of the Puerto Rico Experiment Station, 1937. Includes report on cultivation experiments with *Tephrosia* spp.

PYRETHRIN-CONTAINING MATERIALS

Pyrethrum Culture Planned—Belgium. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 15, 245. Brief note.

Pyrethrum Cultivation Studied—India. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 18, 294. Brief note.

Annual Report of the Department of Agriculture, Kenya, for 1937. Vol. I. Includes reports of the experimental work conducted during the year and the state of the pyrethrum industry.

Annual Report of the Department of Agriculture, Kenya, for 1937. Vol. II. Includes brief reports on analytical work, breeding and selection, drying, and pests and diseases of pyrethrum.

Japanese Pyrethrum Cultivation. *Chem. and Drugg.*, 1939, **130**, No. 3082, 256. Gives areas under crop 1937, 1938 and 1939.

Pyrethrum Acreage Decreased—Japan. *World Trade Notes, U.S. Dep. Comm.*, 1939, **13**, No. 24, 393.

Harvesting Pyrethrum. *Rept. Bur. Agric. Engng., U.S. Dep. Agric.*, 1938, p. 19. Short note describing successful harvesting machine.

Die künstliche Trocknung von Pyrethrumblüten. *Tropenpflanzer*, 1939, **42**, No. 6, 264. Abstract of a paper in *Anz. Schädlingskunde*, **15**, No. 4, 47, relating to the artificial drying of pyrethrum.

Rapport fra Contenuto di Piretrina I e Piretrina II nei Capolini di *Pyrethrum cinerariæfolium* nel corso dello Sviluppo Vegetativo e durante la Conservazione. (Report on the pyrethrin I and pyrethrin II content of the flower heads of *Pyrethrum cinerariæfolium* during growth and storage.) By M. Covello. *Riv. Ital. Ess. Prof.*, 1939, **21**, 117-119.

Constituents of Pyrethrum Flowers. XIV. The structures of the enols of pyrethrolone. By H. L. Haller and F. B. La Forge. *Rep. J. Org. Chem.*, 1939, **3**, No. 6.

Toxicity of various Esters prepared from Chrysanthemum Monocarboxylic Acid. By E. K. Harvill. *Contrib. Boyce Thompson Inst.*, 1939, **10**, No. 2, 143-153.

The Interaction of Bordeaux Mixture Spray, Sulphur, and Pyrethrum Dusts on Potato Yields and Insect Control. By E. O. Mader, W. A. Rawlins and E. C. Udey. *Amer. Potato J.*, 1938, **15**, No. 12, 337-349.

Fly Spray Testing. A discussion of the theory of evaluating liquid household insecticides by the Peet-Grady Method. By C. I. Bliss. *Soap*, 1939, **15**, No. 4, 103, 105, 107, 109, 111.

Can Pyrethrum be used as a Stomach Insecticide ? (In Russian.) By A. K. Voskresenskaya. Summary of Scientific Research Work of the Institute of Plant Protection, Lenin Academy of Science, for the year 1936 (published 1938), pp. 81-83. (*R.A.E.*, 1939, **27**, A, Pt. 6, 310.)

Technical Effectiveness of Pyrethrum Extracts prepared by means of Hot Extraction. (In Russian.) By G. V. Blyumberg. Summary of Scientific Research Work of the Institute of Plant Protection, Lenin Academy of Science for the year 1936 (published 1938), pp. 81-83. (*R.A.E.*, 1939, **27**, A, Pt. 6, 310.)

Inactivation of Pyrethrum after Ingestion by the Southern Armyworm and during Incubation with its Tissues. By P. A. Woke. *J. Agric. Res.*, 1939, **58**, No. 4, 289-295.

Pests of Grain. *Publ. Dep. Sci. Industr. Res.*, 1939. Includes brief reference to use of pyrethrum oil sprays.

Experiments in the Control of Green Apple Bug, Apple Redbug, and Pale Apple Leafhopper by means of Pyrethrum Dust and Sprays. By N. A. Patterson. *Ann. Rep. Ent. Soc. Ontario*, 1937, 18-19.

Untersuchungen zur Bekämpfung des Apfelblütenstechers (*Anthonomus pomorum* L.). (Investigations on the control of the apple blossom weevil.) By H. Theim. *Forschungsdienst*, 1938, **6**, Pt. 12, 597. (*R.A.E.*, 1939, **27**, A, Pt. 6, 298.) Includes use of pyrethrum.

Biology and Combating Practicabilities of the Apple Blossom Stinger (*Anthonomus pomorum* L.). By M. Hanf. *Amer. Chem. Abstr.*, 1939, **33**, No. 9, 3514. Brief abstract of paper in *Gartenbauwiss.*, 1939, **12**, 335-398. Use of contact poison containing pyrethrum.

The Tarnished Plant Bug (*Lygus pratensis*) as an Apple Pest. By O. H. Hammer. *J. Econ. Ent.*, 1939, **32**, No. 2, 259-264. Includes tests with dust containing pyrethrum.

The Bramble Shoot-Webber (*Notocelia uddmanniana* L.). By G. H. L. Dicker. *Ann. Rept. E. Malling Res. Sta., Kent*, 1938, 191-198. Use of pyrethrum sprays for control.

The Control of Strawberry Aphis and Tarsonemid Mite. By R. M. Greenslade and A. M. Massee. *Ann. Rept. E. Malling Res. Sta., Kent,* 1938, 186-190. Use of pyrethrum sprays.

Field Experiments for Control of the Beet Leafhopper in Idaho, 1936-37. *J. Econ. Ent.*, 1939, **32,** No. 1, 69-78. Successful use of pyrethrum oil sprays.

Pyrethrum and Derris as a Control for the Six-Spotted Leafhopper, a Vector of Lettuce Yellows. By B. B. Pepper and C. M. Haenseler. *J. Econ. Ent.*, 1939, **32,** No. 2, 291-296.

The Destruction of Mosquitoes in Aircraft. By F. P. Mackie and H. S. Crabtree. *Lancet,* 1938, **235,** 447-450. (*R.A.E.*, 1939, **27,** B, Pt. 5, 118.) Use of aqueous-base pyrethrum insecticide.

Valeur des Pulvérisations Insecticides dans la Lutte Anti-Malarienne. By P. Moreau. *Rev. Méd. Franç. Extr.-Orient.*, 1938, **16,** No. 3, 264-274. (*R.A.E.*, 1939, **27,** A, Pt. 6, 138.) Includes use of pyrethrum.

Pyrethrum and Oils for Protection against Salt-Marsh Sand Flies (Culicoides). By J. B. Hull and S. E. Shields. *J. Econ. Ent.*, 1939, **32,** No. 1, 93-94.

OTHER INSECTICIDE MATERIALS OF VEGETABLE ORIGIN

Quassia als Wirksames Mittel zur Bekämpfung der Pflaumensägewespen (*Hoplocampa minuta* and *H. flava*). (Quassia as an effective insecticide against the plum sawflies *H. minuta* and *H. flava.*) By H. Thiem. Reprint from *Int. Kongr. Ent.*, 1938, Vol. 7, pp. 19. (*R.A.E.*, 1939, **27,** A, Pt. 6, 297.)

Toxicity Studies of so-called "Inert" Materials with the Bean Weevil (*Acanthoscelides obtectus* Say.) By Shin Foon Chiu. *J. Econ. Ent.*, 1939, **32,** No. 2, 240-248. Includes walnut shell flour.

NOTE.—The reference in brackets—*R.A.E.*, etc.—which appears after certain items of the bibliography indicates the part and page of the *Review of Applied Entomology,* in which an abstract of the publication mentioned can be found.

BOOK REVIEWS

Books for review should be addressed to "The Editor," Bulletin of the Imperial Institute, South Kensington, London, S.W.7.

LE MOUVEMENT DES GRAINS DANS LE MONDE. By Paul van Hissenhoven. Pp. 858, 9½ × 6¼. (Brussels: Éditions Ceres, 1938.) Price 24s.

This book deals with the movement of wheat, rye, barley, oats and maize in the world, and is divided into four parts. The first part deals with the history, characteristics and crop statistics of these grains, the second is devoted to exporting countries, and the third and fourth parts to the marketing of grain in the world's markets.

The author has dealt in detail with all aspects of the subject, and the book contains some very good illustrations,

as well as copies of the various documents such as Bills of Lading, insurance policies, etc., in use in the different centres of the grain trade. In the chapter on exporting countries there is a full account, with statistics, of the industry in each exporting country, and of the various methods by which the product is marketed for export.

The work should be found of considerable value by all those interested in the grain trade, in particular those who are engaged in the buying or selling of grain. It is to be regretted, however, that the author has not been able to include rice in the grains dealt with.

A book such as this is likely to be referred to frequently and is deserving of something better than the thin paper cover in which it has been bound.

FRUIT AND VEGETABLE JUICES. By D. K. Tressler, M. A. Joslyn and G. L. Marsh. Pp. xii + 549, 8 × 5½. (New York: Avi Publishing Company, Inc., 1939.) Price $6.00.

The authors of this book are well qualified to write on the subject of fruit and vegetable juices; all have done important work on the technology of the preparation and preservation of these products. Dr. Tressler is in charge of the Division of Chemistry of the New York State Agricultural Experiment Station and his two co-authors are members of the staff of the Agricultural Experiment Station at Berkeley, California.

This volume, as might be expected, therefore, contains much valuable matter, and moreover is well arranged and very readable. The first chapter is a general one dealing with the rapid rise in the consumption of fruit juices in the United States and the present trend of development. This is followed by a series of five chapters which should be particularly useful to anyone expecting to enter the fruit juice manufacturing business; these relate to the principles of the preparation of juices, the equipment used for preparing, packing and preserving of fruit and vegetable juices, plant layout, and methods and equipment employed in freezing processes for fruit juices. Then follow ten chapters dealing with the individual juices, viz., apple, pineapple, grapefruit, orange, lemon and other citrus juices, grape juice, cherry and berry juices, miscellaneous fruit juices and beverages, tomato juice, sauerkraut juice and other vegetable juices. The remainder of the book comprises a chapter briefly summarising the information available on the nutritive value of juices; one of over forty pages on fruit juice concentrates and syrups; and others on fruit juice beverages, utilisation of fruit wastes and blending formulæ and calculations. There is an appendix, which is of direct

interest only to manufacturers in United States, and deals with the law of that country relating to fruit juices.

A very valuable feature of the book is the inclusion at the end of each chapter of numerous references to literature. The volume also contains an index and is well illustrated with eighty photographs and diagrams.

HANDBOOK OF FOOD MANUFACTURE. By Dr. F. Fiene and Saul Blumenthal, B.S. Pp. vi + 603, 9 × 6. (London: Chapman & Hall, Ltd., 1939.) Price 25*s*.

The authors, who are consulting food chemists in New York, state in their Preface that in the course of their work they have received hundreds of requests for a simple book devoted to the many practical aspects of the food industry, for the use of those who have not had the benefit of a technical training. Their answer is the publication of this *Handbook of Food Manufacture*, the sub-title of which describes the volume as a handbook of practical food information, containing factory-tested commercial formulæ and descriptions and analyses of prepared foods and raw materials for manufacturer, chemist, plant superintendent, food buyer, and broker, in the baking, beverage, confectionery, condiment, essence, fruit juice, fruit, flavour, ice cream, preserving, spice, and allied food industries.

It might well be questioned whether such a compilation is at all possible within the limits of one volume of 560 pages of text, and further whether a first-class food product can be made by a manufacturer who has not available a technical and scientific knowledge of his materials. The authors of this book have, however, covered a wide field and they also claim that if the formulæ and directions which they have given are carefully followed, good commercial products will result.

On reading through this handbook, one is forced to the conclusion that as is inevitable, the subject-matter has suffered through the necessity for condensation. It is doubtful, for example, whether the methods of analyses described towards the end of the book can be adequately carried out by anyone whose knowledge of chemistry is confined to that contained in the first brief chapter. The disadvantages attendant on condensation of subject matter might to some extent have been minimised if there had been included a more detailed and extensive bibliography.

On the other hand, it is difficult to understand why certain matter has been included. It is surely unnecessary to give full details of the methods of using various clarifying enzymes and it is doubtful whether the printing in full of the "Definitions and Standards for Food Products" issued by the Food

and Drugs Administration of the United States Department of Agriculture, is justified. Brief references and particulars of where such information could be obtained would probably have sufficed.

Despite these evident shortcomings, however, there is no question that this book contains a great deal of useful information, and it will doubtless find a demand in some sections of the food industry.

NUTRITION AND DIET THERAPY. By Fairfax T. Proudfit. Seventh Edition. Pp. viii + 923, $8\frac{1}{2} \times 5\frac{1}{2}$. (New York: The Macmillan Company; London: Macmillan & Co., Ltd., 1938.) Price 14*s*.

The latest edition of this book has been rewritten to follow closely the curriculum of the National League of Nursing Education in the United States of America. The large amount of detailed information contained in the 900 pages of text can only have been collected as the result of many years' experience of the subject, and although some of the information given and some of the foods mentioned may not be applicable to the United Kingdom it is felt that this book should find a ready use in this country as well as amongst the students in the United States, for whom it has been specifically prepared.

The subject matter is divided into four parts, namely, "Normal Nutrition" (230 pp.); "Normal Nutrition—Practical Application" (120 pp.), a guide to laboratory lessons; "Diet Therapy" (410 pp.); and "Recipes" (80 pp.). Some idea of the scope of the book may be obtained from the fact that it includes sections on the nutritional requirements of the body, the feeding of infants and of children, meal planning, and a very comprehensive section on diets in specific illnesses. The section on recipes should prove of value and there is also a very full table of food values included as an appendix.

WORLD ECONOMIC REVIEW OF INSECTICIDES AND ALLIED PRODUCTS. Pp. xiii + 149, foolscap, mimeographed. (London: O. W. Roskill & Co. (Reports), Ltd., 1939.) Price 100*s*.

The rapid increase in the use of insecticides during recent years is well known. Although this has been accompanied by a great deal of research work, the results of which are readily available in technical journals and other publications, the questions connected with the economics of the insecticide industry have not received the same attention.

The writer of this report has endeavoured to collect in one volume the information available in the literature regarding sources of supply, competition between different products, prices, data on production and trade, etc. As published statistical and other data is far from complete, it is inevitable, as the author acknowledges, that only an incomplete picture of the insecticide industry can be presented.

After a preliminary chapter in which an attempt is made to trace the development of the use of insecticides and to outline the more important factors influencing the industry, there follow sections dealing with the various groups of insecticide materials, viz., copper sulphate and other copper-containing products, iron sulphate, arsenicals, sulphur, fluorides, nicotine, pyrethrum, rotenone-bearing roots, and other insecticidal products. There is a final section relating to consumption and control regulations. A certain proportion of the information included is only of indirect interest. For example, in the section on fluorides, six pages of information relating to the trade and production of fluorspar, sodium fluoride, and cryolite are given. All these materials, as the author points out, find their principal outlets in other industries, and are little used for insecticide purposes. Further, it has, unfortunately, not been possible to give any details of the amounts of these products employed as insecticides.

On the whole, however, it may be said that this compilation will doubtless be found of value to those interested in the economic side of the insecticide industry.

MINERAL RESOURCES

ARTICLES

THE EMPIRE'S SHARE IN MINERAL PRODUCTION

In 1937 the Mineral Resources Department of the Imperial Institute produced a work entitled the *Mineral Position of the British Empire,* which included a section comparing the mineral output of the world with that of the Empire for 1929 and 1935. As this particular statement proved useful to many inquirers, details are now given whereby the comparisons can be extended to 1937, the latest year for which adequate returns are available.

In making comparisons of the relative importance of minerals it is, of course, frequently impossible to take into account such industrial commodities as building stones, road-making materials and the like on account of the insufficiency of published data regarding production and value. Excluding such commodities, however, the more important minerals of the Empire and the world in general for 1935 and 1937 may be arranged, in approximate order of value, as shown in Table 1.

It will be seen from the figures given that although both the world and British Empire outputs in 1937 were in every instance considerably greater than those of 1935, the percentages contributed by the Empire remained fairly constant, except in the cases of mica, chrome ore, manganese ore and asbestos, which showed large increases in 1937. There are minor increases in the percentages of petroleum, tin ore, silver, potash salts, phosphates, nickel ore, pyrites and bauxite, while small decreases are noticeable for coal, gold, zinc ore, iron ore, copper ore, lead ore, salt, sulphur and diamonds.

As 1937 was a boom period, it is of interest to note that

TABLE I

*World and British Empire Outputs of the more important Minerals for 1935 and 1937 in approximate order of Value**

Minerals.	1935. World Total.	1935. British Empire Total.	1935. Empire Percentage.	1937. World Total.	1937. British Empire Total.	1937. Empire Percentage.
	Long tons.	*Long tons.*		*Long tons.*	*Long tons.*	
Coal	1,310,000,000	288,000,000	22·0	1,510,000,000	313,000,000	20·7
Petroleum	225,000,000	4,020,000	1·8	279,000,000	5,860,000	2·1
†Gold	*29,600,000*	*17,040,000*	57·6	*34,600,000*	*19,720,000*	57·0
Iron ore	140,000,000	17,950,000	12·8	214,000,000	23,360,000	10·9
‡Copper ore	1,470,000	410,000	27·9	2,300,000	570,000	24·8
‡Tin ore	136,000	59,400	43·7	207,000	100,100	48·3
†Silver	*223,000,000*	*37,200,000*	16·7	*271,000,000*	*47,300,000*	17·5
‡Lead ore	1,370,000	545,000	39·8	1,650,000	591,000	35·8
‡Zinc ore	1,540,000	454,000	29·5	1,860,000	535,000	28·8
Salt	31,000,000	5,300,000	17·1	35,000,000	5,800,000	16·6
§Potash	2,470,000	12,900	0·5	3,000,000	22,100	0·7
Phosphates	10,000,000	868,000	8·7	11,400,000	1,260,000	11·1
Sulphur	2,400,000	124,000	5·2	3,600,000	142,000	3·9
‡Nickel ore	76,000	63,300	83·3	113,000	101,600	89·9
Pyrites	8,000,000	450,000	5·6	9,800,000	964,000	9·8
‖ Diamonds	*6,190,000*	*2,501,000*	40·4	*9,610,000*	*3,759,000*	39·1
Asbestos	369,000	255,000	69·1	620,000	458,000	73·9
Manganese ore	4,100,000	1,200,000	29·3	6,100,000	2,240,000	36·7
Bauxite	1,760,000	146,000	8·3	3,660,000	403,000	11·0
Chrome ore	780,000	235,000	30·1	1,280,000	503,000	39·3
Mica	35,000	8,300	23·7	52,000	17,600	33·8

* *Allowance has been made for the outputs in 1937 from U.S.S.R., Japan, Spain and certain other countries for which complete returns are not available.*

† *Fine oz.* ‡ *Metal content of ore produced.* § *K_2O content.* ‖ *Metric carats.*

the world production of all the minerals specified in Table 1, with the exception of coal, shows an increase over the production in 1929, the previous year of maximum activity; the same remarks apply to the British Empire, except that, in addition to coal, the quantity of diamonds produced in 1937 was less.

EMPIRE MINERAL INDUSTRY, 1937

The value of the British Empire mineral output during 1937 is shown in Table 2, from which it will be seen that the United Kingdom accounted for two-fifths, and the Dominions, India and Burma for nearly half the total amount. The African Colonies contributed 4·40 per cent., the Asiatic Colonial Empire 4·48 per cent., and territories mandated either to the United Kingdom or to the Dominions accounted for only 0·61 per cent. of the production.

Coal was by far the most important mineral produced, the value of the output being equivalent to just over 40 per cent. of the total value of the mineral production. Gold accounted for 26 per cent., and the other chief items were: copper ores, 5 per cent.; tin ore, 4½ per cent.; silver-lead-zinc ores, 4 per cent.; nickel ore, nearly 2½ per cent.; iron, manganese and chrome ores, 2 per cent.; petroleum, 2 per cent.

Mineral Fuels

Coal.—The output of coal in the British Empire keeps very constant at about 300 million tons, more than three-quarters of which is contributed by the United Kingdom. India, the Union of South Africa, Canada and Australia together produce more than 90 per cent. of the remainder.

Petroleum.—The yield of petroleum in the British Empire although still small is increasing; in 1937 it was not quite 6 million tons. The chief Empire producers are Trinidad, the Bahrein Islands, Burma, Brunei, Canada, India and Sarawak. Trinidad accounted for more than one-third of the Empire output.

Iron and Ferro-alloy Minerals

Iron.—Of the Empire's output of over 23 million tons of iron ore mined in 1937 more than half was credited to the

TABLE 2

Value of the British Empire Mineral Output during 1937

Country.	Value (£ Sterling).	Percentage of Total.	Chief minerals produced. Figures show percentage value of the country's output.
United Kingdom	208,579,000	40·73	Coal, 87·6; building and road-making materials, 7·5; iron ore, 1·7
Union of South Africa	94,292,000	18·41	Gold, 87·6; diamonds, 3·7; coal, 4·5
Canada	92,468,000	18·06	Gold, 31·3; copper, 13·1; nickel, 13·0; coal, 10·6; lead, 4·6; zinc 4·0; asbestos, 3·2; silver, 2·25
Australia	24,266,000	4·74	Coal, 24·9; gold, 24·0; silver-lead-zinc ores, 25·7; iron ore, 7·1; copper ore, 4·5
Federated Malay States	18,155,000	3·54	Tin, 95·9
India	15,942,000	3·11	Coal, 36·8; manganese ore, 20·3; gold, 14·3; mica, 6·8; petroleum, 6·5
Northern Rhodesia	12,751,000	2·49	Copper, 90·7; cobalt, 5·2; zinc, 2·6
Burma	9,276,000	1·81	Petroleum, 48·2; lead-copper-zinc-silver ores, 33·2; tin and tin tungsten ores, 15·4
Southern Rhodesia	7,483,000	1·46	Gold, 75·6; asbestos, 11·1; coal, 6·7; chrome ore, 4·9
Gold Coast	4,261,000	0·83	Gold, 58·8; manganese ore, 27·4; diamonds, 13·8
New Zealand	3,146,000	0·61	Coal, 58·2; gold, 36·3
Nigeria	2,906,000	0·57	Tin, 89·2; gold, 6·4
Trinidad	2,697,000	0·53	Petroleum, 95·8
Newfoundland	1,975,000	0·39	Lead-zinc-copper ores, 57·2; iron ore, 42·1
Sierra Leone	1,666,000	0·32	Diamonds, 65·1; iron ore, 19·5; gold, 15·1
South-West Africa	1,641,000	0·32	Diamonds, 71·4; vanadium, 12·1; copper ore, 11·4
New Guinea	1,530,000	0·30	Gold, 100
Unfederated Malay States	1,468,000	0·29	Iron ore, 56·4; tin, 33·6
Cyprus	1,128,000	0·22	Cupreous ore and pyrites, 70·8; asbestos, 11·2
Other British Empire	6,500,000	1·27	Gold, 30; petroleum, 30; phosphate rock, 13
TOTAL	512,000,000	100·00	

United Kingdom. India, Australia, Malaya, Newfoundland, Sierra Leone and the Union of South Africa contributed practically all the remainder of the total. Although Sierra Leone has been producing for only a few years, shipments in 1937 exceeded 630,000 tons. The Newfoundland output rose from 660,000 tons in 1935 to 1·6 million tons in 1937.

The amount of pig-iron produced in the Empire was more than 12 million tons, and of steel more than 16 million tons, about three-quarters of which in each case was made in the United Kingdom.

Manganese.—The output of manganese ore in the Empire was about 2¼ million tons during 1937, nearly half of which was produced in India, the other large producers being the Union of South Africa and the Gold Coast, each with an output of well over half a million tons. About 33,000 tons were produced in the Unfederated Malay States (Trengganu and Kelantan) and minor quantities were contributed by Northern Rhodesia, Australia and Canada.

Tungsten.—Tungsten ores, which are in great demand for the manufacture of special steels, are obtained from many parts of the Empire, but the greater part of the output is derived from Burma, where it is mined in conjunction with tin. The estimated amount of tungsten concentrate (WO_3 content) recovered in Burma during 1937 was 3,250 tons. Other important outputs (on the same basis) were: Federated Malay States, 621 tons; Australia, 480 tons; Southern Rhodesia, 160 tons; Unfederated Malay States, 157 tons; United Kingdom, 83 tons. Minor quantities were obtained in the Union of South Africa, South-West Africa, New Zealand, India, Nigeria, Tanganyika Territory and Uganda.

Chrome.—The Empire output of chrome ore during 1937 was 500,000 tons, of which Southern Rhodesia (in that year the world's largest producer) contributed more than 270,000 tons, the Union of South Africa nearly 170,000 tons, and India just over 60,000 tons; small amounts were also obtained from Canada, Cyprus, Sierra Leone, Australia and the United Kingdom.

Nickel.—Most of the world's nickel ore output comes from Canada, where more than 100,000 tons (in terms of metal) were produced in 1937. About 1,200 tons of nickel were contained in the nickel-speiss obtained as a by-product of smelting in

Burma; this was exported to Hamburg for refining. A few tons of ore have been produced in Southern Rhodesia each year since 1935.

Cobalt.—Cobalt is obtained in the Empire from Northern Rhodesia, Canada and Burma. Until recent years Canada was the chief source of supply, but has now been surpassed by Northern Rhodesia, which produced 870 tons in 1937, whilst Canada produced 226 tons. The estimated amount of cobalt in the nickel-speiss shipped from Burma to Hamburg was 270 tons.

Vanadium.—This is obtained in the Empire only from Northern Rhodesia and South-West Africa. In 1937 the former produced 232 tons, in terms of metal, and the latter 5,264 tons of concentrates, containing about 20 per cent. vanadic oxide.

Columbium and Tantalum.—Columbite, which has been in some demand for metallurgical purposes during the past few years, is recovered chiefly in Nigeria in connection with tin mining. In 1937 this Colony produced 717 tons, of which 410 tons came from the Kuru area. The proved reserves amount to about 10,000 tons. Tantalite is found chiefly in Western Australia where production was about 20 tons during the same year. Other Empire countries producing tantalite-columbite minerals were Uganda, South-West Africa, Union of South Africa, Southern Rhodesia and India.

Molybdenum.—Empire requirements of this metal are obtained almost entirely from foreign sources. Small quantities of molybdenite are produced in Australia, Canada and Burma.

Base-Metal Minerals

Lead and Zinc.—The amount of lead occurring in ores produced in the Empire during 1937 was almost 600,000 tons and of zinc 535,000 tons. In both cases Australia is the chief source, followed by Canada. Australia supplied just over 40 per cent. of the lead and just under the same proportion of zinc, whilst Canada produced rather under one-third of the lead and slightly over one-third of the zinc. Burma accounted for one-sixth of the lead and one-tenth of the zinc, Newfoundland for one twentieth of the lead but one-ninth of the zinc. Zinc ore was also produced in Northern Rhodesia and the United Kingdom. Likewise lead ore was also produced in

the United Kingdom and South-West Africa, in addition to which small amounts were raised in Nigeria, the Union of South Africa, Southern Rhodesia and Tanganyika.

Cadmium.—This metal is obtained as a by-product in zinc refining, and in 1937 was produced in Canada (745,000 lb.), Australia (464,000 lb.) and the United Kingdom (274,000 lb.). A quantity is produced in South-West Africa in the form of flue dust which is sent to Germany for treatment.

Copper.—The metal content of copper ore mined in the Empire in 1937 exceeded half a million tons, over 40 per cent. of which was supplied by Northern Rhodesia, and a similar amount by Canada. The total is made up by smaller amounts from Cyprus, Australia, South-West Africa, the Union of South Africa, India, Newfoundland and Burma.

Tin.—The metal content of tin ore produced in the Empire during 1937 was over 100,000 tons, three-quarters of which was accounted for by the Federated Malay States and one-tenth by Nigeria ; other countries producing 2,000 - 5,000 tons were Burma, Australia, Unfederated Malay States and the United Kingdom. Smaller quantities were obtained in the Union of South Africa, Uganda, Tanganyika, South-West Africa, Southern Rhodesia, Swaziland, Straits Settlements and Northern Rhodesia.

Aluminium.—Only four countries in the British Empire produce bauxite, the chief source of aluminium. The Empire output of bauxite was 400,000 tons in 1937, of which all but about 40,000 tons was credited to British Guiana, the remainder being supplied by the Unfederated Malay States, India and Australia. Of the British Guiana output, about 65,000 tons of low-grade material were not shipped, but put on the dump. The Empire production of aluminium was 60,000 tons, about two-thirds of which were produced in Canada (chiefly from British Guiana bauxite), the remaining third being produced in the United Kingdom.

Magnesium.—Magnesite is produced in India, Canada and Australia, in each case the annual output being 20,000 tons or more. The only other Empire producer is the Union of South Africa.

Mercury (Quicksilver).—Comparatively small quantities of mercury are produced in Australia and New Zealand.

Antimony.—Antimony ore is obtained chiefly in Australia,

the production in 1937 being 567 tons. Small amounts are also won in Southern Rhodesia, Burma and Sarawak.

Arsenic.—In 1937 3,368 tons of white arsenic were produced in Australia, 620 tons in Canada, and 95 tons in the United Kingdom.

Bismuth.—Bismuth is recovered in the United Kingdom as a by-product of smelting operations, and is obtained as metal and bullion in Canada. Bismuth ore is mined in Australia, Union of South Africa and Burma. The production in Canada of metal as such and that contained in bullion was 51 cwt. during 1937, whereas in 1936 it reached 3,251 cwt.

Precious Metals and Stones

Gold.—The production of gold in the Empire is steadily increasing each year and in 1937 reached a record of 19,720,000 oz., of which the Union of South Africa contributed 11,735,000 oz., Canada 4,096,000 oz. and Australia 1,381,000 oz.; other large Empire producers are Southern Rhodesia, Gold Coast, India, New Guinea and New Zealand, whilst smaller quantities are obtained in many other parts of the Empire. The output of the Union of South Africa in 1937 was a record, although a lower grade of ore was crushed, the average being just below 4 dwt. per long ton.

Silver.—This metal is chiefly obtained as a by-product in the smelting of copper, lead and zinc ores. In 1937 the Empire produced over 47 million oz., nearly half of which came from Canada, over one-quarter from Australia and one-eighth from Burma. More than one million oz. were obtained from the Union of South Africa and Newfoundland respectively; smaller quantities came from other British Africa, New Zealand, Cyprus, New Guinea, United Kingdom, India, Malaya and Fiji.

Platinum.—The British Empire is the world's chief supplier of the platinum metals, the principal source being Canada, where they are shipped in the form of nickel-copper matte, which is refined in the United Kingdom and in Norway. The Canadian production of platinum in 1937 was about 140,000 oz., in addition to other platinum group metals amounting to about 120,000 oz. The Union of South Africa supplied a further 45,000 oz. of platinum, while minor quantities were obtained in Australia, Sierra Leone, New Zealand and Papua.

Diamonds.—The production of diamonds (including bort and diamond sand exported from the Gold Coast) in 1937 was about 3⅝ million metric carats, over 25 per cent. of which came from the Union of South Africa, 40 per cent. from the Gold Coast, 25 per cent. from Sierra Leone, 5 per cent. from South-West Africa and 1 per cent. from British Guiana. Reckoned by value, however, the Union of South Africa accounted for over 50 per cent. of the Empire output. Small quantities were also obtained in Tanganyika Territory, India, Australia and Southern Rhodesia.

Other Gemstones.—Compared with diamonds, the production of other gemstones in the Empire is not of great importance. The chief outputs in 1937 were: opals in Australia valued at £18,000; jadeite in Burma, £13,000; emeralds in Union of South Africa, £11,000; rubies in Burma, £7,000; tourmaline, etc., in South-West Africa, £4,600. Various gemstones are won in Ceylon; pearls are obtained from the Bahrein Islands and Ceylon.

Industrial Earths and Clays

China Clay.—By far the most important output of the Empire and in fact of the world is from the Cornish deposits in the United Kingdom, which yielded over 830,000 tons during the year under review. Production of about 17,000 tons was obtained in the Federated Malay States and a similar quantity in Australia. Minor quantities were obtained in Burma and the Union of South Africa.

Diatomaceous Earth.—Diatomite was mined or quarried in the British Empire during 1937 to the extent of about 12,000 tons, just over 7,000 tons of which came from Northern Ireland, 3,000 tons from Australia, 1,000 tons from the United Kingdom, 600 tons from Canada, 150 tons from the Union of South Africa, and a few tons from Barbados.

Fuller's Earth.—This earth is produced in the United Kingdom, but the amount is not officially published. The only other Empire producing country is India, which produced just over 7,000 tons in 1937.

Miscellaneous Non-Metallic Minerals

Asbestos.—The production of asbestos in the British Empire rose to the record figure of nearly 460,000 tons in 1937, of which

370,000 tons were supplied by Canada, 51,000 tons by Southern Rhodesia, 25,000 tons by the Union of South Africa, 11,000 tons by Cyprus, and between 100 and 200 tons each by India and Australia. The Canadian output in 1937 was a record for any year to date.

Mica.—India is the principal Empire producer of mica, and in 1937 exported about 7,500 tons of splittings, 1,500 tons of block mica and 6,000 tons of scrap mica. The Union of South Africa produced 1,700 tons (chiefly scrap), while Canada produced nearly 850 tons, of which 600 tons was scrap. Small quantities of mica were also produced in Australia, Tanganyika Territory, Northern and Southern Rhodesia and Ceylon.

Lithia Mica.—South-West Africa produced over 1,000 tons of lithia mica in 1937. A small amount was also produced in Canada.

Gypsum.—The 1937 recorded production of the Empire was about 2¼ million tons, of which the United Kingdom and Canada each contributed over 1 million tons. Small quantities were produced by Australia, India, the Union of South Africa, Cyprus, Eire and Palestine. The returns are not complete, as often the gypsum used for cement-making is not recorded.

Talc.—This mineral was mined chiefly in India and Canada, output of the former being 13,000 tons in 1937 and of the latter 11,000 tons. Smaller quantities were obtained in Australia and the Union of South Africa.

Felspar and China Stone.—In 1937 more than 60,000 tons of china stone were produced in the United Kingdom; while 19,000 tons of felspar were obtained from Canada, nearly 4,000 tons from Australia and 500 tons from India.

Graphite.—The output of graphite in the British Empire is obtained very largely from Ceylon, which contributed 17,400 tons in 1937. Relatively small amounts, however, were produced in Canada and India, while a few tons were also produced in the Union of South Africa and Australia.

Titania.—The Empire supply of titania is obtained chiefly from the beach sands of Travancore, where the ilmenite output was over 180,000 tons in 1937. During the same year Federated Malay States supplied 6,000 tons of "amang," and Canada almost 4,000 tons of ilmenite. Some 2,000 tons of ilmenite and rutile were obtained from sands in Australia

(New South Wales). A few tons of rutile were also produced in South-West Africa.

Monazite.—This is supplied from the beach sands of Travancore, India.

Zircon.—This mineral is produced from the beach sands of Travancore, India, and from certain sands in New South Wales, Australia. The production of the former in 1937 was over 1,300 tons and of the latter 5,250 tons.

Corundum.—Virtually the world's entire output of natural corundum comes from the Union of South Africa, which produced 2,247 tons in 1937. A few tons, however, are also produced in Southern Rhodesia.

Minerals for Chemical Industries

Barium.—The chief Empire source of barium minerals is the United Kingdom, which produced over 60,000 tons of barytes in addition to nearly 12,000 tons of witherite in 1937. During the same year India produced nearly 16,000 tons of barytes, Australia just over 3,000 tons and the Union of South Africa between 500 and 600 tons.

Strontium.—Celestite is obtained only in the United Kingdom, the production of which was 7,600 tons in 1937.

Fluorspar.—The output of fluorspar in the Empire was about 60,000 tons during the year under review, the United Kingdom contributing two-thirds and Newfoundland one-fifth. Other producers were: Union of South Africa (3,558 tons), Australia (1,442 tons) and Canada (134 tons).

Nitrates.—Nitrate of potash (saltpetre) is obtained in India to the extent of 9,000 to 10,000 tons annually. The material, except for a few hundred tons used on tea plantations, is exported.

Salt.—Empire output of salt, including that produced from sea-water, is estimated at between 5 and 6 million tons each year, over half of which comes from the United Kingdom, other large producers being India, Canada and Aden.

Potash.—The amount of potash obtained in the Empire is very small, the only two sources of supply being potassium chloride obtained from the waters of the Dead Sea in Palestine and potassium nitrate obtained from India. The estimated K_2O equivalent of the 1937 output was 22,000 tons.

Bromine.—The only important source of bromine in the

Empire is the Dead Sea in Palestine. More than 500 tons were recovered from this source in 1937.

Phosphates.—Nauru Island, Ocean Island and Christmas Island are the principal sources of supply of Empire phosphates. In 1937 the production of Nauru Island was nearly 700,000 tons, Ocean Island almost 400,000 tons, Christmas Island (Indian Ocean) just over 160,000 tons. About 10,000 tons of phosphatic guano was exported from Seychelles and small quantities of phosphate rock were produced in India, Tanganyika, Canada and Australia.

Pyrites.—The chief Empire source of pyrites (cupreous) is Cyprus, which contributed about 800,000 tons during 1937. During the same year Canada produced 100,000 tons, which, however, included concentrates of iron pyrites resulting from the treatment of copper ore. Small amounts are also mined in Australia, the Union of South Africa, Southern Rhodesia and the United Kingdom.

Sulphur.—With the exception of about 500 tons of native sulphur produced in Palestine, the mineral is not mined in the Empire. The chief sources of production of recovered sulphur are (1) spent oxide in the United Kingdom, (2) smelter gases in Canada. Sulphur is also obtained from iron pyrites in certain Empire countries.

Selenium.—This material was recovered in the Empire during 1937 from the smelting of lead-zinc ores, chiefly in Canada (400,000 lb.); about 1,500 lb. was also obtained from Northern Rhodesia.

Uranium Minerals.—The Empire output of these minerals is confined to Canada, which in 1937 produced 23,770 milligrams of radium and 546,000 lb. of radium-bearing salts.

ZIRCON-RUTILE-ILMENITE BEACH SANDS OF NEW SOUTH WALES

Deposits of naturally concentrated heavy minerals occur at many places along the coast of New South Wales between the mouth of the Shoalhaven river in the south and the Queensland border in the north, the areas of greatest concentration being found between the mouth of the Richmond river at Ballina and that of the Brunswick river at Brunswick Heads.

The composition of the deposits, which are in the form of

beach sands, varies considerably from place to place. The predominant mineral is zircon, which is present in amounts varying from 45 to 75 per cent., the principal other minerals present being rutile (10 to 30 per cent.) and ilmenite (10 to 20 per cent.). As commercial sources of zircon and rutile, therefore, the New South Wales sands can compare very favourably with other known deposits of these minerals.

The coast line in the area consists of a number of rocky headlands separating arc-shaped beaches, which vary in length from 3 to 7 miles and in width from 100 to 200 ft. at low tide. Behind the beaches, and running parallel with them for their full length, are sand dunes or terraces, 15 to 20 ft. in height, which extend inland for about 100 yds.

A certain amount of concentration by wind action takes place on the seaward side of the dunes. The normal prevailing wind during fine weather builds up the terraces with sand consisting mainly of silica but also containing some of the heavier minerals. Any increase in the intensity of the wind, however, tends to bring about a degree of sorting, carrying the silica further inland and leaving thin layers of the heavier minerals as black sand.

A much more extensive and more effective concentration is produced by wave action, particularly between the months of May and November, i.e. the winter months, when heavy seas occur most frequently. The beaches, which have acquired a slope as a result of the wind action during the fine weather, are levelled out by the waves, which remove the silica in preference to the heavy minerals. Wave action is most pronounced in the case of storms from the south-east, and after such storms the beaches may be black for a considerable extent in the vicinity of high-water mark because of the almost complete removal of the silica.

The natural concentrates thus formed are commonly in the form of a number of individual layers, each representing a period of concentration, i.e. a storm, followed by a period of fine weather with normal sand deposition. The layers vary in thickness from ¼ in. to a maximum of 3 to 4 ft. and may extend along the beach for a mile or more, with a maximum width of 80 ft. It follows that after a storm a large tonnage of naturally concentrated sand may become available. This natural concentrate, which is the raw material used industrially,

is dug out at low tide and transported to dumps on the landward side of the dunes for storage and further concentration by artificial means as required.

The colour of the natural concentrate varies from pale grey to very dark grey according to the amount of ilmenite present. Microscopic examination shows that the grading is very even and that the principal constituents are zircon, ilmenite, and rutile, other minerals present including monazite, magnetite, chromite, tourmaline, garnet, cassiterite, spinel, etc.

The following analyses show the chemical composition of two sands from the northern section of the coast (*The Mineral Industry of New South Wales*, by E. C. Andrews and others; Sydney, 1928, p. 184).

Sample No. 1 is a natural beach concentrate from between the Richmond river and Evans Heads and Sample No. 2 from a point two miles south of Evans Heads.

	No. 1.	No. 2.
	Per cent.	*Per cent.*
ZrO_2	50·78	43·77
TiO_2	14·00	23·50
Al_2O_3	1·72	0·34
Cr_2O_3	0·42	0·34
FeO	4·83	4·48
MnO	0·25	trace
MgO	0·42	0·44
P_2O_5	0·24	1·25
SnO_2	trace	3·81
SiO_2	27·46	20·36
Rare earths	trace	1·61
Organic matter	trace	0·32
Gold	1 dwt. 7 gr. per ton	1 dwt. 10 gr. per ton
Platinum metals	less than 10 gr. per ton	less than 10 gr. per ton

The above analyses probably represent the following approximate mineral composition:

	No. 1.	No. 2.
	Per cent.	*Per cent.*
Zircon	78	64
Ilmenite	10	9
Rutile	9	18
Cassiterite	—	4
Monazite	—	3

The relative proportions of the various minerals are never constant and, although cassiterite and monazite are normally minor constituents of the sand, they have been reported in

individual deposits in quantities amounting to 26 and 34 per cent. respectively.

The zircon is nearly all of the colourless variety, although some pale pink and pale blue grains are present. Inclusions, often of rutile, are common.

Rutile occurs in the sand as broken or imperfect crystals, or as rounded grains, and varies in colour from deep red through various shades of brown to deep yellow, many of the darker grains being almost opaque.

The ilmenite grains are generally much smaller than the rutile and are always rounded. The grain surfaces often show pitting under reflected light.

Although large quantities of naturally concentrated material are available and can be dug out at very little cost, early attempts to work the sands were rendered abortive on account of the difficulties encountered in separating the constituent minerals. Recent work has, to some extent, surmounted these difficulties and various separation methods are now being used successfully.

The magnetic method is the most suitable for the separation of ilmenite and is the only one employed for this purpose on a commercial scale in New South Wales. Separation of garnet and monazite may also be effected by this means, but the zircon in the New South Wales sands appears to be definitely non-magnetic.

The electrostatic method, which depends on the different electrical conductivities of the minerals, is believed to offer distinct possibilities for the separation of zircon and rutile but is not employed commercially.

The development in Australia of flotation methods for the separation of zircon and rutile has given excellent results but, unfortunately, details of the methods employed have not been made public. That in use by Zircon Rutile, Ltd., is stated to permit of the almost complete removal of zircon from the natural concentrate, the mineral having a purity of over 99 per cent. The remaining rutile-ilmenite concentrate is not separated further as it can command a ready market in that state.

Three products are marketed by Zircon Rutile, Ltd.—zircon, rutile-ilmenite, and "electrode mixture" (W. R. Poole; *Chem. Engng. Min. Rev.*, 1939, **31**, 251).

The standard grade of zircon contains over 99 per cent. $ZrSiO_4$ and chemical analysis of a typical concentrate shows 66·4 per cent. ZrO_2. This bears very favourable comparison with standard samples of commercial zircon from other parts of the world.

The rutile-ilmenite mixture varies in composition between the following limits: ilmenite, 34 to 37 per cent.; rutile, 58 to 62 per cent.; other minerals, 5 per cent. On magnetic separation a typical sample yielded:

Ilmenite (48·4 per cent. TiO_2) . .	36·3 per cent.
Rutile (94·0 per cent. TiO_2) . ..	61·7 per cent.
Garnet, etc.	2·0 per cent.

The "electrode mixture," which is prepared specially for use in the coating of electrodes employed in arc-welding, is somewhat similar to the rutile-ilmenite product. The chemical analysis shows 70·5 to 72·2 per cent. of TiO_2 and about 17·0 per cent. of FeO. The product is quite free from sulphur and very low in phosphorus, both of which may be harmful in welding processes.

The electric welding industry has developed rapidly in recent years and much experimental work has been directed towards finding a satisfactory coating for the welding rods. The best type of coating serves to stabilise the arc during the process, is not absorbed by the weld metal, and possesses sufficient viscosity to maintain a protective covering over the metal. Rutile gives very satisfactory results but is somewhat expensive, and ilmenite alone is unsuitable. The rutile-ilmenite mixture is less expensive and has been used successfully as a coating material.

Commercial development of the New South Wales beach sands commenced when Industrial Metal Deposits, Pty., Ltd. was formed in Melbourne in 1933 to carry out investigations on them. A small pilot plant was erected at Auburn, Victoria, and a satisfactory method of producing concentrates of zircon, rutile and ilmenite was evolved. The company went into active production in 1934 under the name of Zircon Rutile, Ltd., 51 tons of zircon-rutile-ilmenite concentrates, valued at £(A)471, being recovered in that year. During 1935 this company completed the erection of concentrating plant at Byron Bay, New South Wales, for the treatment of concentrates by flotation methods developed in their laboratories.

The Titanium Alloy Manufacturing Company of New York installed a small concentrating plant at Yamba in the same year and the International Titanium Company of Toronto commenced operations at New Brighton. The production for the year amounted to 1,823 tons of zircon and 300 tons of zircon-rutile-ilmenite concentrates, valued in all at £(A)12,691.

Work continued in 1936, Messrs. Porter and Anderson, working on behalf of the Titanium Alloy Manufacturing Company, recovering a zircon-rutile-ilmenite concentrate which was transported in bulk to the United States for further treatment. The quantity of sand treated amounted to about 7,500 tons containing approximately 2,604 tons of zircon and, in addition, 247 tons of zircon was recovered by Zircon Rutile Ltd. from sites on Seven Mile Beach and near Ballina. Production of zircon-rutile-ilmenite concentrates during the year was valued at £(A)4,863.

Extensions to the plant, including additional cells for the concentration of zircon by froth flotation, were carried out at Byron Bay by Zircon Rutile, Ltd., in 1937. The installation of a magnetic separator for separating rutile and ilmenite is contemplated. Sand treated by the company amounted to 657 tons, yielding 339 tons of zircon and 72 tons of rutile-ilmenite. Shipments of concentrates to the Titanium Alloy Manufacturing Company, New York, by Messrs. Porter and Anderson contained, it is stated, 4,912 tons of zircon, 1,123 tons of rutile, and 670 tons of ilmenite. Total production for the year amounted to 5,252 tons of zircon, 1,123 tons of rutile, 670 tons of ilmenite, and 72 tons of rutile-ilmenite mixture, valued in all at £(A)21,155.

Bibliography

Report of the Department of Mines. Sydney, N.S.W. (Annual).

"The Mineral Industry of New South Wales." By E. C. ANDREWS and OTHERS. Sydney, 1928, pp. 183-185.

"The Mineralogy and Origin of the Natural Beach Sand Concentrates of New South Wales." By H. F. WHITWORTH. *J. Roy. Soc. N.S.W.*, 1931, **65**, 59-74.

"Zircon and Rutile from Black Sands." *Chem. Engng. Min. Rev.*, 1934, **26**, 388.

"Zircon and Rutile from Beach Black Sand Deposits." By W. R. POOLE. *Chem. Engng. Min. Rev.*, 1939, **31**, 216-220, 250-257.

REPORTS OF RECENT INVESTIGATIONS AT THE IMPERIAL INSTITUTE

Selected from Reports made to the Dominions, Indian and Colonial Governments

ARTIFICIAL POZZOLANA AND SAND-LIME BRICKS FROM FIJIAN RAW MATERIALS

In many remote regions of the Empire the provision of adequate supplies of hydraulic materials, such as Portland cement, for building purposes, is often a matter of great difficulty on account of the high cost of imported cement or the impracticability of manufacturing such a product locally on a small scale. Where impure limestones of suitable composition occur, and fuel is available, the local preparation of hydraulic lime may be feasible, but failing this, Portland cement must, perforce, be used, or some cheaper substitute must be sought.

In many localities the use of natural or artificial pozzolanic materials as substitutes for Portland cement (in cases where lime can be obtained) does not appear to have received the consideration that the possibilities of these materials perhaps deserve.

Pozzolanas, as defined by Lea and Desch (*The Chemistry of Cement and Concrete*, 1935, p. 244), are materials which, though not cementitious in themselves, contain constituents which will combine with lime at ordinary temperatures in the presence of water to form stable insoluble compounds possessing cementing properties.

Such substances may be either natural or artificial. The most active natural pozzolanas are generally materials of volcanic origin which have undergone chemical alteration and have thereby been converted into a more reactive modification. Certain diatomaceous earths also possess pozzolanic properties. Artificial pozzolanas are obtained by the calcination of certain clays, shales, and siliceous rocks.

Pozzolana lime mortars can replace cement mortars for many purposes. Concrete can, moreover, be made from a suitable aggregate and a pozzolana-lime mixture, the latter taking the place of the cement which is ordinarily incorporated. The concrete may not be equal in strength, at early ages, to a

Portland cement concrete containing an amount of cement equivalent to that of the pozzolana-lime mixture employed, but can nevertheless be used for constructional purposes. In Italy pozzolana-lime mortars and concretes are said to be still regarded with favour for sea-water work, a mix composed of 1 part by weight of lime to 3 of pozzolana and 7½ of sand or ballast being used. The hardening of pozzolana-lime concretes is, however, slow, and an addition of Portland cement, to the extent of about 12 to 25 per cent. by weight, to the pozzolana-lime mix is therefore often made. It is said that with this addition the concrete can be exposed without damage to the wash of waves within a day after placing. The rate of development of strength of pozzolana-lime mortars is much increased by rise in temperature, and it is stated by the Building Research Board that a pozzolana which is comparatively inert for weeks at the average temperature prevailing in this country, and therefore of little value here, may prove satisfactory under tropical conditions. A long period of moist curing is essential to the development of high strength, and rapid drying has injurious effects.

In view of the above considerations, an account of an investigation recently carried out at the Imperial Institute may draw attention to the possibility of the employment of pozzolanas where suitable raw materials are available.

The samples which originated the investigation described were sent by the Public Works Department, Fiji, in order that their suitability for building purposes might be ascertained, and included, amongst other materials, coral, quartz sand, and red clay. The latter was said to be apparently a direct decomposition product of the andesitic flows of which the island of Viti Levu is chiefly built.

The results of chemical analyses and preliminary tests at the Institute, and a consideration of local conditions, such as cost of fuel, in Fiji, indicated that the manufacture of Portland cement from the coral and clay would probably be impracticable. The clay was also found to be unsuitable for making bricks, and investigations into its pozzolanic properties were therefore made so that no aspects of its possible utilisation for the purpose required should be overlooked.

The suitability of the coral and sand for making sand-lime bricks was also considered.

The three samples which were employed in this investigation were as follows:

Coral.—A fairly soft variety of white coral, mainly in the form of lumps about 3 to 5 in. diameter, some faces being stained dark grey with organic matter.

Clay.—A highly plastic red coloured clay received in a moist condition. It was air dried before examination.

Rewa Sand.—A finely divided light brown sand, consisting chiefly of somewhat corroded quartz and well-rounded limonitic grains.

Chemical analyses of the coral and clay gave the following results:

		Coral. *Per cent.*	Red clay. *Per cent.*
Silica	SiO_2	0·70	35·02
Alumina	Al_2O_3	0·57	23·17
Ferric oxide	Fe_2O_3	0·28	13·22
Titanium dioxide	TiO_2	not detected	1·08
Lime	CaO	52·61	not detected
Magnesia	MgO	0·70	2·30
Sulphuric Anhydride	SO_3	0·60	0·37
Phosphoric anhydride	P_2O_5	not detected	1·48
Carbon dioxide	CO_2	40·84	not detected
Loss on ignition, less CO_2		3·39	22·97
		99·69	99·61

A sieving test made on the Rewa sand showed it to have the following mechanical composition:

	Per cent.
Retained on No. 14 B.S. sieve	0·5
Passing No. 14, retained on No. 18 B.S. sieve	0·2
,, ,, 18 ,, ,, ,, 25 ,, ,,	0·5
,, ,, 25 ,, ,, ,, 36 ,, ,,	5·9
,, ,, 36 ,, ,, ,, 52 ,, ,,	37·9
,, ,, 52 ,, ,, ,, 72 ,, ,,	35·4
,, ,, 72 ,, ,, ,, 100 ,, ,,	13·9
Passing No. 100 B.S. sieve	5·7
	100·0

The proportion of voids was found to be 42 per cent.

It will be seen from the above table that the grain size of the bulk of the sand lies between the apertures of a No. 36 and a No. 100 B.S. sieve; it is therefore finer than that usually employed in cement mortars.

1. *Examination of the Red Clay as an Artificial Pozzolanic Material*

The coral, crushed to fragments of about 1 in. cube, was burnt at a temperature of 950° C. for 2½ hours and slaked with water. It slaked slowly but well, yielding a finely divided material entirely free from lumps.

The red clay was calcined at a temperature of 700° C. for 2 hours and then ground until about 5 per cent. residue was left on a No. 170 B.S. sieve.

As there is no British Standard Specification for pozzolana the calcined red clay was tested according to the German specification for Trass (D.I.N.DVM. 1043-1931) in order to obtain a definite indication of its capabilities as a pozzolanic material. This specification requires that mechanically compacted briquettes and cubes made from a standard mortar composed of 0·8 parts by weight of standard hydrated lime, 1 part trass (or pozzolanic material), and 1·5 parts of standard sand, should yield the following average minimum strengths:

	7 days (3 days in moist air, 4 days in water.)	28 days (3 days in moist air, 25 days in water.)
Tensile strength ... (*kg. per sq. cm.*)	5	16
Compressive strength (,, ,, ,, ,,)	45	140

The results obtained from tests using the calcined red clay in place of trass with pure hydrated lime and standard sand, in the proportions indicated above, were as follows:

	7 days (3 days in moist air, 4 days in water.)	28 days (3 days in moist air, 25 days in water.)
Tensile strength ... (*kg. per sq. cm.*)	13·6	22·8
Compressive strength (,, ,, ,, ,,)	60·3	182

The figures recorded are in each case the mean of six results.

It will be seen that these results are much superior to those required by the specification for commercial trass.

Mortars were then made using calcined red clay, Rewa sand, and lime prepared by calcining the coral, and were tested for tensile and compressive strength. The test pieces in this series were stored for 3 days in moist air and for the remainder of 28 days, 3 months, and 6 months, in water at a temperature of 60° F. ± 5°. The results are shown in the following table.

Mortars made from Coral Lime, Calcined Red Clay and Rewa Sand

(Lime previously hydrated, but not ground)

Mixture.	Tensile strength (lb. per sq. in.)			Compressive strength (lb. per sq. in.)		
	At 28 days.	At 3 months.	At 6 months.	At 28 days.	At 3 months.	At 6 months.
5 parts sand, 4 parts calcined clay, 1 part lime (water used for gauging, 20·5 per cent.)	178	223	242	586	1,533	2,184
10 parts sand, 4 parts calcined clay, 1 part lime (water used for gauging, 18 per cent.)	110	130	148	576	1,437	1,841
15 parts sand, 4 parts calcined clay, 1 part lime (water used for gauging, 17 per cent.)	67	83	113	465	768	1,169

The tensile strengths recorded are in each case the mean of six results; the compressive strengths at 28 days and 3 months are each the means of four results, and at 6 months are the means of three results.

It will be observed that the strength of the mortar increases very considerably with ageing, until at 6 months from the date of gauging the compressive strength of one of the mixtures exceeds 2,000 lb. per sq. in.

It was found, in a series of preliminary experiments which were made, that a mortar having a tensile strength of 222 lb. per sq. in. at 28 days from gauging could be made from a mixture of 10 parts of standard cement-testing sand, 4 parts calcined red clay and 1 part of coral lime. This strength is twice that of the corresponding mixture incorporating Rewa sand, and indicates that the latter, possibly on account of its content of a quantity of rounded limonitic grains, is not an ideal aggregate for use in mortars. Since, however, it was desirable that the investigation should be carried out entirely with local products, further ageing tests were not carried out with the standard sand mixture. It appears probable, however, that if a pure quartz sand could be employed in place of the Rewa sand, a mortar having an even greater strength than that recorded would result after a prolonged period of ageing.

2. *Examination of the Coral and Rewa Sand with respect to their suitability for making Sand-Lime Bricks*

It was understood that the Government of Fiji had under consideration the question of making sand-lime bricks in the Colony, and experiments were therefore made at the Institute to ascertain if such bricks could be made from the Rewa sand in conjunction with coral lime.

A mixture of 90 per cent. Rewa sand and 10 per cent. hydrated lime prepared from the coral was made and moulded into bricks under a pressure of 5,000 lb. per sq. in. The bricks were subjected to steam at 130 lb. per sq. in. pressure for a period of 6 hours in a hardening chamber, and were then of good colour, strong and free from flaws. When dried at 105° C. and subjected to crushing tests the following figures were obtained :

Strength of Sand-lime Bricks made from 90 per cent. Rewa Sand and 10 per cent. Hydrated Lime prepared from Coral

	Compressive Strength *lb. per sq. in.*
	3,027
	2,816
	2,758
	2,799
Average	2,850

The British Standard specification for sand-lime bricks (No. 187, 1923) requires that class A (Engineering) bricks should show an average crushing strength of not less than 2,800 lb. per sq. in. In the commercial manufacture of sand-lime bricks a period of 8 hours steaming at 130 lb. pressure is normally employed, and the results obtained in these tests after 6 hours treatment are therefore very satisfactory. A high-grade silica sand is usually employed in the manufacture of these bricks, but with the Rewa sand some compensation for its deficiency in this respect is probably made by a partial combination of the limonitic material with the admixed lime.

The results show that the coral, clay and sand are a potential source, after appropriate treatment, of building materials possessing considerable strength.

The operations involved in the preparation of the lime-pozzolana mixtures are simple, and the cost of manufacture

should not be high. The clay is calcined at a temperature of about 700° C., which should be readily attainable with wood fuel, and the burnt material is not difficult to grind to the appropriate degree of fineness. Provided that the coral is properly burnt to lime a satisfactory product should be obtained.

A hardening chamber and a supply of steam under pressure is necessary for the manufacture of sand-lime bricks, but the process of manufacture is otherwise comparatively simple.

PROGRESS IN COLONIAL MINERAL INDUSTRY

Comprising periodic statements on mining and geological activities received from Government Technical Departments overseas.

BECHUANALAND

The following statement received from the Government Secretary shows the production of gold and silver for the three months ended May 31, 1939.

	Troy oz.	Value.
Gold, bullion .	2,488·11	£23,426 16*s.* 11*d.*
„ fine . .	3,926·86	
Silver . .	154·76	£9 2*s.* 9*d.*

The gold premium amounted to £1,434 1*s.* 4*d.*

Considerably more than half the gold output was obtained from two mines—the Monarch and the Phoenix.

BRITISH GUIANA

The following report has been received from the Director of the Geological Survey of British Guiana concerning the activities of the Survey during the first half of 1939.

Geological Survey

Surveys were made over the areas (*a*) west of Aremu Mine, Cuyuni, (*b*) south-west of Peters Mine, Puruni, and (*c*) in the Tamakay district, Mazaruni, by the Director, by Mr. D. W. Bishopp, and by Dr. D. A. Bryn Davies respectively.

Area (a).—The area between the Cuyuni and Puruni Rivers

immediately west of the Aremu Mine was examined by cross traverses at two mile intervals cut from a main south line connecting Waikuri (Cuyuni) to the Puruni (a distance of about 25 miles) and from two main east lines (about 16 miles long) connecting the south line to the Quartzstone-Aremu trail.

The area covered consists of an alternating series of phyllites and sheared volcanic rocks with predominant structures running west-north-west. A number of dolerite dykes trending east-north-east traverse the central portion of the area; they occur within a belt about six miles wide and are evidently the south-westerly extension of the similar belt which crosses the Cuyuni River at Tinamu, Paiyuka and Stop-off Falls. This group of basic intrusives persists, therefore, for a distance of at least 40 miles and further mapping may reveal an extension into the Puruni-Mazaruni area.

Outlying remnants of deposits of the White Sand Series occur in the southern portion of the area and represent a south-westerly extension of the alluvial belt postulated by the Director as occurring " between the Blue Mountain-Breakdown Mountain ridge on the one side and the Sodam-Supenaam ridge on the other." The latter ridge has its corresponding extension across the northern part of the area mapped in a belt of rugged country with a maximum altitude of 1,000 ft. The White Sand belt evidently crosses the Puruni River and it seems probable that further mapping will reveal its connection with similar deposits in the diamond-bearing areas between the Mazaruni and Puruni Rivers.

Dissected benches of porous laterite occur between the White Sand deposits and the high ridge referred to above. A number of small workable gold deposits were found in association with the lateritic deposits and with rocks of the volcanic series. No indications of diamonds were found, although it seems possible that such may occur within the White Sand areas.

Area (b).—The area of about 400 sq. miles in extent, covered by mapping during this season, is that of the quadrangle between the Mazaruni and Puruni rivers east of a line drawn from between Tiboku and Morabisi on the former, to Paiyuka Falls on the latter. An aerial reconnaissance was first made over this region, and over the rugged Sororieng massif which lies to the west of it. The mapped area thus fills up the gap between the examinations previously made by the survey south of the Mazaruni at Semang and Issano and north-east of Peters Mine on the Puruni.

Geology and Topography.—The Puruni valley south of Peters Mine, and the Mazaruni from Puruni mouth to Issano, are occupied by the granitic gneiss of the region and by some non-foliated granite. The contact of the latter with the

metamorphic and volcanic rocks of the "Volcanic Series," higher up the Mazaruni, runs north-west from Issano to Morabisi and beyond. A square area of about 10 miles side, in the angle of the Puruni, including and north of Peters Mine, is composed of basic metamorphic rocks and dolerites. The southern margin of this square, a little south of Peters Mine, is in contact with the granites and gneisses which occupy the rest of the area southward to the Mazaruni; but in this region there are a number of outliers and sills of fresh dolerite which form appreciable hills lying like cakes upon the granitic basement.

The section of the Puruni River between Stop-off Falls and Paiyuka Falls reveals a series of dark argillaceous shales or schists, epidiorites, some granite, fine exposures of volcanic agglomerates and dolerite; areas occupied by basic rocks have a remarkably rugged topography.

The line between Morabisi and Paiyuka Falls, which is the western limit of the area examined, is represented by a considerable ridge or escarpment of fresh dolerite, at least 30 miles in length and breached by the Morabisi in a deep narrow gorge. This ridge appears to be integral with the dolerite ridges of the Semang and Tiboku, and many lesser occurrences which are shown on the map. To the west of this line the aerial observations indicate that the country between Puruni and Mazaruni is occupied by a vast mass of dolerite rising to the peak of Sororieng, which is about 2,500 ft. in height, and extending toward the lowlands of the Pashanamu Valley. Most of the dolerite appears to be in the form of sills with feeder dykes.

Economic Geology.—There is no evidence of mineralisation within the dolerites or granitic rocks. The contact zone of the latter with metamorphics about 4 miles up the Morabisi contains small auriferous quartz veins which have broken down to form a limited but satisfactory eluvial deposit, covered by a few claims now worked by "pork-knockers."

The square of metamorphic and intrusive rocks including and to the north of Peters Mine contains numerous old workings—none very large—particularly at a site on the Puruni known as Timmerman's Landing. Here a few "pork-knockers" are re-working the old deposits in creeks and hillsides. A small and shallow but rich eluvial deposit on a granitic margin about 6 miles to the south of Timmerman's Landing was discovered by the Survey, and has probably now been worked out by "pork-knockers" who were following the party.

The contact-zone near Morabisi Mouth, and the block of about 100 sq. miles in the angle of the Puruni north and west of Peters Mine, are the only known auriferous areas in the region mapped. So far as can be ascertained at present, these

are of a character best adapted to exploitation by small-workers who are now in the area. The origin of the gold, from vein quartz almost *in situ*, is clear; and there is always the possibility that larger quartz veins capable of being mined may be discovered in the portions indicated. The dolerite region to the westward of the Puruni Valley sets a probable limit to the area in which exploration would be feasible.

Area (c).—In the Tamakay area there appear to be three main quartz reefs closely related to the edge of a large granitic intrusive. These have been worked at the surface by local miners using small stamp mills and are reported to have produced some 4,000 oz. of gold. Some further exploration by drilling appears justified.

In this area there are a number of diamond workings. These occur within a belt of country situated a few miles north of the Mazaruni River. This belt is separated from the latter river by high, rugged lateritic country and in all probability was formerly occupied by the White Sand Series, remnants of which with worn gravels occur on some of the hill summits.

A well-defined mineralised zone in the quartzites and epidiorites occurs about one mile from and parallel to the granite contact referred to above. Mineralised quartz reefs are not known to occur within this zone, however.

Recent Mining Developments

Gold.—As hitherto, with the exception of 4,135 oz. produced by the two dredges of the British Guiana Consolidated Goldfields Co. in the Mahdia River, the gold has been produced from a large number of small alluvial and quartz milling operations.

The machinery imported for use in the Aranka goldfield, referred to in the previous half-yearly report, is now being transported up the Cuyuni River and is expected to be installed and to commence operations in the next few months. It is understood that a small milling and washing plant is to be installed in the Aurora section of the Cuyuni.

Bauxite.—There have been no further local developments in connection with the mining of bauxite in the Berbice district.

Mineral Oil.—The Seismic Survey of the Courantyne-Berbice area is being continued, and the Central Mining and Investment Corporation have recently extended their holdings in this area.

Manganese.—A number of enquiries have been received in regard to the deposits in the North West District, but no exclusive permission to prospect has as yet been issued.

MINERAL PRODUCTION—BRITISH GUIANA, 1939

	1st quarter.	2nd quarter.
Gold	8,646 oz. 6 dwt. 4 gr.	10,504 oz. 15 dwt. 10 gr.
Bauxite	75,170 tons	*Not available*
Diamonds	56,709 stones = 7,744 carats	69,173 stones = 8,657 carats

MINERAL EXPORTS

		1937.	1938.	1939 (first 6 months).
Gold	*oz.*	39,047	39,728	17,848
Bauxite	*tons*	300,707	376,368	181,042
Diamonds	*carats*	34,556	33,508	15,122

CYPRUS

The Inspector of Mines has submitted the following data regarding mineral production during the second quarter of 1939.

The production of pyrites, asbestos, gold and silver show considerable increases as compared with the previous quarter ended March 31, 1939.

There was an increase in the tonnage of gypsum exported while a marked decrease in the tonnage of cupreous pyrites exported is recorded.

No chrome ore was exported during the period under review.

MINERAL PRODUCTION AND EXPORTS, APRIL-JUNE 1939

	Production. *Tons.*	Exports. *Tons.*
Cupreous pyrites (dry weight)		
Skouriotissa Mine	32,876	39,567
Mavrovouni Mine	187,632	104,305
Lymni Mine	2,365	—
Kalavaso Mine	13,619	26,090
Cupreous concentrates (dry weight)		
Mavrovouni Mine	—	33,298
Chrome ore		
Mined	1330	—
Retreated	400	—
		Troy oz. fine.
Gold (contained in ores, concentrates and precipitates)	—	5,264*
Silver (contained in ores, concentrates and precipitates)	—	40,168*
Asbestos (Tunnel Asbestos Cement Co., Ltd.)		*Tons.*
Rock mined	527,000	—
Rock treated	125,085	—
Asbestos fibre	4,135	2,920
Other minerals exported		
Gypsum, calcined	—	994
Gypsum, raw	—	1,500
Terra umbra	—	2,005
Terra verte	—	5
Manganese ore	—	7

* *Based on provisional returns.*

GOLD COAST

The following report on the activities of the Gold Coast Geological Survey for the half-year ended June 30, 1939, has been supplied by the Acting Director.

During this period the detailed surface and underground examination of the mines of the Tarkwa goldfield was continued and completed, and the Memoir on this field, which will include the new geological map, is in course of preparation. Considerable progress was made in the detailed mapping of the country surrounding the Konongo gold belt, preparatory to the investigation of the geology and ore-deposits of the mines in the belt. The belt of country known as the Bibiani Range was mapped and prospected from the Anglo-French frontier near Siwum to the Kumasi-Bechem road, and prospects along the Siwum-Tokosea gold belt and elsewhere were examined. The Appollonian rocks of Western Nzima (the country west of Axim), which are interesting on account of their possibilities as an oil-bearing series, were studied, while geological examination was made of the major part of the coast line from west of Axim to the neighbourhood of Accra. During this work manganese-ore deposits near Dixcove and Axim were investigated.

The work of the water-supply section was concentrated mainly in the Dagomba district, with some work in Gonja. In these areas most of the works carried out were storage reservoirs—dams, ponds and underground tanks of a type evolved from the old native tanks found in the neighbourhood. A large dam at Savelugu was almost completed at the end of June. In the second quarter well-sinking was commenced in the south-west part of the Gambaga District.

According to returns furnished by the Controller of Customs, Accra, the exports of minerals during the first half of 1939 were as follows:

Gold	*fine oz.*	392,405
Diamonds	*metric carats*	634,045
Manganese ore	*value*	£289,339

KENYA

The Acting Commissioner of Mines reports that Kenya Consolidated Goldfields Ltd. have commenced mining and milling on their Kitere properties in the South Kavirondo district.

The production of gold in the various Kenya goldfields for the period January to May 1939 is given in the table. on p. 446.

KENYA—PRODUCTION OF GOLD (JAN.—MAY, 1939).

Goldfield.	January.	February.	March.	April.	May.	Total (Jan.—May).
Kakamega						
Lode :						
Tons treated	9,081	7,850	9,331·25	8,540	9,474·75	44,277
Refined gold recovered . . . . *oz.*	2,636·650	2,553·650	2,731·196	2,775·828	2,810·224	13,507·548
Alluvial :						
Cu. yds. treated	26,938	19,456·4	17,980·8	39,042·4	42,027	145,444·6
Refined gold recovered . . . . *oz.*	290·739	198·215	246·884	209·534	347·148	1,292·520
No. 2 Area						
Lode :						
Tons treated	11,954	19,133	13,369·8	11,323·65	12,820·6	68,601·05
Refined gold recovered . . . . *oz.*	1,979·558	4,499·396	2,443·975	1,872·235	1,977·807	12,772·971
Alluvial :						
Cu. yds. treated	77	37	100	37	77	328
Refined gold recovered . . . . *oz.*	3·810	1·206	5·654	1·230	3·091	14·991
South Kavirondo (Gori River)						
Lode :						
Tons treated	3,183	3,197	4,251·3	5,371·8	5,098·7	21,101·8
Refined gold recovered . . . . *oz.*	877·352	953·397	788·038	1,085·682	1,256·602	4,961·071
Masai Province (Lolgorien)						
Lode :						
Tons treated	707	345*	1,040	440	160	2,692*
Refined gold recovered . . . . *oz.*	239·841	226·439	99·783	71·841	13·292	651·196

* Incomplete returns.

MALAY STATES (FEDERATED)

The following data for the period April to June 1939 have been compiled from returns furnished by the Chief Inspector of Mines.

PRODUCTION OF TIN-ORE

State.	Metal content (Long tons).	Value (£).
Perak	4,389	930,505
Selangor	2,392	511,454
,, (buffer stock)	27	5,805
Negri Sembilan	250	52,178
Pahang	303	64,869
Total	7,361	1,564,811

Other minerals produced were: gold, 9,226 troy oz.; coal, 88,226 tons (all from Selangor, and excluding coal produced and consumed at the colliery); china clay, 74 tons; and haematite, 120 tons (all from Perak). Exports include wolfram, 5 tons; scheelite, 25 tons; and amang, 2,637 tons.

MALAY STATES (UNFEDERATED) AND MALACCA

According to returns furnished by the Chief Inspector of Mines exports of minerals during the second quarter of 1939 were as shown below.

EXPORTS OF MINERALS, APRIL-JUNE 1939

State.	Tin in ore at 75.5 per cent.	Gold.	Manganese ore.	Wolfram.	Bauxite.	Iron ore.
	(Long tons.)	(Oz.)	(Long tons.)	(Long tons.)	(Long tons.)	(Long tons.)
Johore	137	—	—	—	13,423	204,650
Kedah	40	—	—	44	—	—
Perlis	39	—	—	—	—	—
Kelantan	6	287	4,613	—	—	112,980
Trengganu	68	—	7,100	39	—	363,622
Malacca	20	1	—	—	—	—
Total	310	288	11,713	83	13,423	681,252

JOHORE

The following information compiled from a report supplied by the Acting Warden of Mines relates to the progress in mining during the second quarter of 1939.

Tin-ore.—The production of tin-ore is regulated and exports correspond with the quota releases permitted.

The tonnage of tin-ore from all sources exported during the period was: April, 134·80; May, 29·16; June, 17·15; making a total of 181·11 tons valued at $244,451·06.

Of this total, 137·49 tons were exported from Johore Bahru, 37·26 tons from Kota Tinggi, and 6·36 tons from Penggerang.

The proportion of the total exports of tin-ore won from mines owned or managed by Europeans was 29·13 per cent. as compared with 70·87 per cent. from mines under Chinese management.

Iron-ore.—Exports of iron-ore for April amounted to 73,759 tons, for May 70,800 tons, and for June 60,092 tons; making a total of 204,651 tons for the quarter. Of this, 95,885 tons were exported at Endau (east coast) and 108,766 tons at Batu Pahat (west coast).

In Johore iron-ore is valued at $5·00 per ton for the purpose of assessing export duty, which is 10 per cent. *ad valorem.*

Bauxite.—The Kim Kim Bauxite Mine, which is situated near Pulau Nanas on the south coast of Johore, ceased work on April 30 owing to certain unforeseen difficulties being encountered, but the mine is expected to resume operations in the near future.

Exports of bauxite during the period under review amounted to 13,423 tons, of which none was exported during April. During May 6,769 tons and during June 6,654 tons were exported, all from Batu Pahat (west coast).

In Johore bauxite is valued for purposes of assessing export duty at $5·00 per ton, the export duty being 10 per cent. *ad valorem.*

Gold.—The production for the second quarter of 1939 amounted to 5·25 troy oz.

A royalty of 2½ per cent. *ad valorem* is paid on gold in Johore, the price being fixed at $58·00 per oz. troy by Government for the purpose of assessing royalty.

NIGERIA

The following statement comprises (1) a report by the Director of the Nigerian Geological Survey on the work carried out by his Department during the period January-June 1939, and (2) an abstract of some notes on mining activities during the first and second quarters of 1939, forwarded by the Acting Chief Inspector of Mines.

Geological Survey

Considerable progress has been made with examination and mapping of the sedimentary rocks of Sokoto Province.

During the half-year a survey was made of the Gwandu and Argungu Emirates, which form the west of the province and have an area of 8,867 sq. miles. Except for the south-east of Gwandu Emirate, where rocks belonging to the vast crystalline complex of Central Nigeria occur, the whole of this area is underlain by sedimentary rocks. The northern half of the area is occupied by a great thickness of unfossiliferous clayey grits and clays known as the Gwandu Group. This group occurs also in Sokoto Emirate, where it overlies a series of limestones and shales which yield abundant vertebrate and invertebrate fossils of early Eocene age. When this group of calcareous beds is traced into Gwandu and Argungu it thins out and disappears. The thinning out of limestone-shale beds had been observed during previous reconnaissance surveys, and it was believed that the beds had been overstepped by the Gwandu Group, which was thought to extend southwards and to occupy the whole of Southern Gwandu and Argungu up to the crystalline boundary. This season's work has shown, however, that Southern Gwandu and Argungu are occupied by a distinct series of clays and grits which have a gentle northerly dip and appear to pass beneath both the Gwandu Group and the Eocene limestone and shales. The results are of considerable interest since they suggest that a wide area in south-western Sokoto, which has been considered to be post-Eocene, should now be regarded as Cretaceous.

In the Southern Provinces revision and extension of the work on the Coalfield is in progress.

Water Supply.—Well sinking has been continued in Bornu, Sokoto, Kano, Katsina, Bauchi and Owerri Provinces. Geophysical prospecting is being carried out in the Nsukka district of Onitsha Province, and will later be carried southwards into Calabar Province. During the half-year 69 new wells have been brought into production.

The drill has successfully penetrated the Rima sands at Sokoto, and has reached a depth of 500 ft. Several aquifers have been encountered in this very fine-grained series, and drilling is being continued in the hope of encountering a coarse stratum nearer the base of the series.

Mining Activity

Tin.—The quota for free export, duly shipped, was increased from 35 per cent. (plus 10 per cent., i.e. 378 tons, to the Buffer Stock Pool) in the first quarter, to 40 per cent. of the Standard Tonnage in the second quarter, mine stocks increasing from 3,307 to 4,322 tons of metal (estimated at 72·5 per cent. Sn in the ore). In the second quarter 1,503 tons of ore, valued at £244,437, were exported, and 2,571 tons produced, as

compared with 1,313 tons valued at £204,729 exported, and 2,152 tons produced in the first quarter.

Gold.—There were no outstanding developments during the period reviewed, though there was a slight decrease in production from 6,406 oz. (930 fine), valued at £44,220, to 6,129 oz. valued at £42,316 for the second quarter.

Columbite.—After a period of stagnation, 28·4 tons of columbite were exported at the end of the first quarter, and there was a considerable increase in the second quarter, when 169 tons were exported. Production during the first quarter was 76·5 tons and during the second quarter 105 tons.

Wolfram.—Since information became available in January 1939 of the quantity of wolfram being won in the Bauchi Province by Nigerian Tin and Exploration Co. Ltd., there has been a miniature rush to the field and an appreciable portion of the country pegged. In the first quarter 36·95 tons were exported and in the second quarter 79 tons. Production during these periods was 45·95 tons and 74 tons respectively. There was a steady demand during the second quarter although the price fell to about 49*s.* per unit towards the end.

NORTHERN RHODESIA

The following statements relating to mining activities during the second quarter of 1939 are taken from a report furnished by the Chief Inspector of Mines.

Prospecting.—A certain amount of prospecting activity continued, notably in the Abercorn, Mkushi, Mumbwa and Kasempa Districts, and 38 prospecting licences were issued, but only eleven locations, nine for gold and two for mica, were registered during the quarter. Diamond drilling to test copper occurrences near the Anglo-Belgian boundary was continued.

Mining.—The quarter was again, on the whole, an uneventful one and copper quotas remained at 100 per cent. of basic tonnages. The total value of the minerals produced at £2,578,906 was slightly less than for the preceding quarter, but nearly £500,000 more than for the corresponding quarter of last year. Production of gold and of mica was slightly more than double that of the first quarter of the year. The increase in gold is mainly accounted for by increased production at the Dunrobin mine of Luiri Gold Areas Ltd., plus some production from Nkana and from Mufulira. The large increase in silver production as compared with the previous quarter was due to production from accumulated refinery slimes at Nkana.

MINERAL PRODUCTION, 1939

	April-June.	January-June.
Gold . . .	1,636 *oz.*	2,433 *oz.*
Silver . . .	42,689 „	52,593 „
Cobalt alloy . .	17,998 *cwt.*	37,495 *cwt.*
Copper, blister . .	41,501 *tons*	82,691 *tons*
„ electrolytic .	7,345 „	14,890 „
Manganese ore . .	446 „	446 „
Selenium . . .	1,277 *lb.*	1,277 *lb.*
Vanadium pentoxide .	163·42 *tons*	331·87 *tons*
Zinc. . . .	3,195 *tons*	6,245 *tons*
Limestone . .	11,585 „	21,143 „
Mica . . .	1,900 *lb.*	2,830 *lb.*
Silica rock . .	1,253 *tons*	3,046 *tons*

Gold.—At the Dunrobin gold mine where crushing had been resumed in February, much-needed additional power plant and better pumping equipment were installed. During the quarter 7,730 tons of ore were treated and bullion containing 1,135 oz. of fine gold recovered.

Copper.—The quantities of ore treated and metal produced by the Mufulira, Nkana and Roan Antelope mines are shown in the subjoined table.

Mine.	Ore treated.		Copper recovered.				Copper Content.
			Blister.		Electrolytic.		
	Tons.	*Per cent. Cu.*	*Tons.*	*Per cent. Cu.*	*Tons.*	*Per cent. Cu.*	*Tons.*
Mufulira .	381,054	4·49	13,789	99·46	—	—	13,714
Nkana . .	561,608	3·47	12,015	99·25	7,334	99·95	19,265
Roan Antelope	583,928	3·23	15,697	99·49	—	—	15,617
Total .	1,526,590	3·63	41,501	99·41	7,334	99·95	48,596

By-products recovered at the Nkana mine included 298½ oz. gold, 41,977 oz. silver, 17,998 cwt. cobalt alloy (averaging 40·40 per cent. cobalt and 15·15 per cent. copper, and containing 7,271 cwt. of cobalt metal) and 1,277 lb. selenium (99·5 per cent. Se).

By-products recovered at the Mufulira mine were 122½ oz. gold and 645 oz. silver.

At the Mufulira mine, by the end of the quarter, No. 5 shaft had reached a depth of 1,332 ft. and the excavation of the 1,250 ft. loading station had been completed. A considerable amount of sand filling of worked-out stopes was carried out. It was decided to equip all underground employees with electric hat lamps and it was also decided to make a gradual change over to detachable bits. The new waste-heat boiler was brought into operation under direct firing pending the completion of the second reverberatory furnace.

At the Nchanga mine, extensive development and drainage work was carried out during the quarter. The sinking of the "A" and "B" inclined shafts below the 480 ft. level was continued. The cross-cut from "B" shaft at the 360 ft. level intersected the ore-body and foot-wall raises were started in preparation for a top-slicing method of stoping. The sinking of the vertical shaft known as "C" shaft to the 1,236 ft. level was completed and excavation of the ore and waste passes and of a spillage raise well advanced. The erection of a pilot plant, having a probable capacity of upwards of 500 tons a day, was approaching completion by the end of the quarter.

In the Nkana section of the Nkana mine, No. 4 shaft was sunk to its final depth of 1,820 ft. and a sub-inclined shaft started from the 1,450 ft. level some 300 ft. south of No. 4 shaft. Good progress was made with development on the 1,450 ft. and 1,680 ft. levels. Reclamation work was carried out above the 750 ft. level. In the Mindola section development work drew well ahead of stoping requirements. The new reverberatory furnace at the Nkana smelter was brought into operation during the quarter.

At the Roan Antelope mine the sub-inclined shaft was completed to the 1,060 ft. level. In the Storke shaft section development was in progress on the 1,440 ft. and 1,930 ft. levels. Progress was made with the installation of the conveyor belt from the Storke shaft to the primary crushers at Beatty shaft, a distance of over 7,000 ft. The erection of new fine ore bins was completed and they were brought into use, giving a fine ore storage capacity in the neighbourhood of 9,000 short tons.

Zinc and Vanadium.—The Broken Hill mine treated 16,945 tons of ore averaging 20·9 per cent. Zn, 3·9 per cent. Pb and 0·7 per cent. V_2O_5 and recovered 2,152 tons of electrolytic zinc (99·98 per cent. Zn) and 1,043 tons of debased zinc (99·21 per cent. Zn), giving a total of 3,195 tons averaging 99·73 per cent. Zn and containing 3,186 tons of zinc metal.

The Company further treated 14,774 tons of vanadium ore containing 1·36 per cent. vanadium and recovered 163·42 tons of fused vanadium pentoxide containing 215,072 lb. vanadium.

By the end of the quarter the new six-compartment shaft had been sunk to a depth of 32 ft. and lined with concrete to within about 3 ft. of the bottom, a temporary head-frame and loading shutes erected, wood guides put in and electric sinking hoists installed. At the Davis shaft the excavation of the two pump chambers at the 1,085 ft. level was completed and most of the steel work erected, the excavation of the settling sumps was well advanced and the two permanent drainage pumps were installed.

Manganese ore.—446 tons of ore, averaging 20·65 per cent. Mn, were mined at Chowa for use as a reagent in the production of zinc at Broken Hill.

NYASALAND

The following report of the work of the Geological Survey for the period January to June 1939 has been supplied by the Acting Director, together with some notes on prospecting activities.

Both the Director and the Geologist, Mineral Survey, were on leave for the whole of the period under review. The Acting Director was occupied in the preparation of the Annual Report and the Water Supply Progress Report, and in the supervision of the Colonial Development Water Supply operations.

Water-boring programmes are being carried out in Dowa and Upper Shire Districts, two bore-holes having been completed in each district.

Well-sinking operations were commenced in Kota Kota, Lilongwe, Dowa and Dedza districts, a total of 62 wells being now under construction.

No further developments have yet resulted from the prospecting operations recently carried out upon the Kapiridimba kyanite deposits. The company concerned is carrying out investigations in connection with separation of the ore by flotation.

The prospecting of the Mlanje bauxite deposits continues, and results to date as regards both quality and quantity of ore available are believed to be satisfactory.

PALESTINE

The following information concerning the mineral industry of Palestine has been submitted by the Government Geologist.

Mineral production during the first six months of 1939 was as follows:

	Tons.	
Potash (80 per cent. KCl)	36,925	
Bromine (refined)	226·32	Export only
Magnesium chloride	46	Export only
Sulphur	841	
Rock salt	377	

Considerable interest is being taken in prospecting for oil and a further two oil prospecting licences have been granted to the Palestine Mining Syndicate Ltd. in the Dead Sea region. Licence No. 12 covers an area of approximately 482 sq. km. and Licence No. 13, 498 sq. km. The licences are contiguous,

the eastern boundary of each being the Palestine Trans-Jordan frontier and the western boundary being approximately line 1718 east on the Palestine grid. Licence No. 12 is bounded on the north by line 0658 on the Palestine grid and Licence No. 13 on the south by line 0406 north. Eighteen oil prospecting licences have also been granted to Petroleum Development (Palestine) Ltd. in the Negeb. Further details of their location and extent will be published at an early date in the *Palestine Gazette*.

SARAWAK

According to the Chief Secretary, the reported production of gold for the period March 1 to May 31, 1939, was 4,467·452 fine oz., of which 4,384·490 oz. were obtained from the Bau District, and 82·962 oz. from the Kuching District. The increase over the previous quarter amounted to 679·404 oz. The area covered by Mining Leases at the end of May was 6,181 acres, and, of the 39 leases extant, 37 grant the right to mine gold and silver, the others covering cinnabar and quicksilver. Eleven Exclusive Prospecting Licences for gold and silver, each issued for a term of one year and covering in all 2,449·22 acres, were in existence during the period under review.

SIERRA LEONE

The Chief Inspector of Mines reports the following mineral production for the first quarter of 1939, corresponding figures for the first quarter of 1938 being shown in brackets: crude gold and unrefined gold bullion, 11,528 (10,485) troy oz.; estimated fine gold, 10,634 (9,687) troy oz.; coarse crude platinum, 31 (93) troy oz.; chromite exports, nil (497) tons. Figures for diamond production and iron ore exports are not available.

During the quarter the average number of Africans employed in prospecting was 238, in mining 16,822, and in miscellaneous services connected with the industry 573, making a total of 17,633.

TANGANYIKA

The following data have been received from the Acting Chief Inspector of Mines.

The provisional value of minerals produced in the Territory and exported during the period April to June 1939 was £251,437. This is an increase of £93,350 over the equivalent quarter of 1938 and £40,490 over the first quarter of 1939. Details of exports for the half-year are contained in the following comparative statement, the figures of which are subject to adjustment in accordance with sales accounts when received:

EXPORTS OF MINERALS

	January-June 1939.		January-June 1938.	
	Quantity.	Value (£).	Quantity.	Value (£).
Gold (unrefined bullion) . .	85,219 *troy oz.*	418,502	52,214 *troy oz.*	270,907
Diamonds . .	1,727 *carats*	4,048	1,400 *carats*	1,839
Tin-ore . .	165 *tons*	26,223	222 *tons*	29,145
Tungsten-ore .	6 *cwt.*	58	45 *cwt.*	414
Salt . . .	2,205 *tons*	13,553	2,099 *tons*	13,159
Mica (Sheet) .	15 ,,	—	9 ,,	—
,, (Waste) .	2 ,,	—	8 ,,	—
Total value .		462,384		315,464

The increase of £146,920 or 46·6 per cent. in the value of mineral exports during the first half of 1939 as compared with the first half of 1938 was mainly due to increased gold production from reef sources.

Gold.—In the Lupa goldfield the Saza mine came into production during the second quarter of 1939. The mill capacity of this mine is approximately 100 tons a day. At the Buhemba mine, Musoma district, new plant to increase the mill capacity to 100 tons a day also came into use. The mono-cable aerial ropeway, nine miles in length, for transporting ore from the Ridge " 8 " mine to the Geita mine mill, came into operation. In June the Geita mill treated 7,895 long tons of ore, which is the largest amount crushed in any one month since the plant came into operation at the beginning of the year.

The output of alluvial gold, the main source of which is the Lupa Goldfield, continued to decline.

The following statement shows the output of the five chief producing gold mines for the months of January to May, 1939. Figures for June were incomplete at the time of preparation of these notes:

	Tons crushed.	Tons cyanided.	Troy oz. Unrefined gold bullion.
Mara Mine (South and Central African Gold Mines Ltd.)	12,167	12,167	8,966
Geita Mine (Geita Gold Mining Co. Ltd.)	27,919	27,919	7,500*
Buhemba Mine (South Nyanza Development Co. Ltd. and Buhemba Mines Ltd.)	6,014	3,467	4,357
Sekenke Mine (Tanganyika Central Gold Mines Ltd.)	10,825	10,855	4,348
Saza Mine (New Saza Mines Ltd.) . .	4,768	4,768	2,981†

* *Fine oz.* † *Part of April and May only.*

Diamonds.—The production of diamonds from the alluvial gravels at Mabuki and Shinyanga in Lake Province continued on a small scale.

Tin-ore.—The exports of tin concentrates from the Karagwe tin-field during the second quarter of 1939 showed a decline as compared with the equivalent period of 1938.

Mica.—Exports of sheet mica showed a satisfactory increase.

Gold Occurrences of the Kahama Region.—" The Preliminary Report on the Geology and Gold Occurrences of the Kahama Region " is the title of Short Paper No. 21 of the Geological Division of the Department of Lands and Mines. The area dealt with extends from Busanda, Rwamugaza and Mawe Meru in the north-west to Kahama and Isaka in the south and south-east and forms part of the Mwanza-Musoma geological province in which many gold mines have already been established. Two zones only are of economic interest : the Rwamugaza-Mawe Meru belt of upper Basement-Complex rocks, and the Mhandu Hills. In addition there are indications of gold in a number of other places, though no payable alluvial gold deposits have as yet been found in the area. Considerably more prospecting is desirable, though investigations are frequently rendered difficult, though not impossible, by the thick cover of lateritic ironstone.

A New Mineral Field.—Commencing prospecting in 1934 on the Rhodesian border to the south, and afterwards working northwards, M. J. de la V. Poussin, a Belgian geologist, first found gold in the Mpanda River in 1936 and galena veins near Mpanda Camp in 1937. Subsequently the area was examined by the Geological Survey, part of the cost being borne by the Colonial Development Fund (1935), and the district has now been described in Short Paper No. 22 (1939) of the Geological Division under the title " Outline of the Geology of the Uruwira Mineral Field," which is accompanied by a geological map of the area.

The field is situated on the borders of Kigoma and Tabora districts in the Western Province, 208 miles by road from Tabora, and lies on the edge of the Miocene peneplain which is here slightly warped down to the Mpimbwe and Katavi plains. These form the north-west extension of the Rukwa trough. The general geology of the area bears a strong resemblance in some respects to the Musoma and Lupa goldfields and consists of a Basement Complex of para-gneisses, ortho-gneisses and meta-sediments on which rest deposits of sands and clay. The distribution of the quartz-reefs and veins relative to the granite periphery shows that there is a concentration of the veins near the granite contact. Practically all the reefs containing primary sulphides, or limonite derived from them, occur in the belt of amphibole and biotite gneiss of the Basement Complex, the gold occurring as a secondary mineral liberated during the decomposition of the sulphides. There is, in addition, evidence of supergene metasomatism,

ferriferous solutions from an oxidised body of ore having replaced the country rock. The occurrence of galena and chalcopyrite together with limonite and secondary copper minerals also points toward a derivation from pre-existing upper zones of mineralisation.

Two fissure veins of galena have been found ¾ mile north-east of Mpanda Camp. Of these, the western or Mkwamba vein is being exploited. Assays show that the ore yields 82·12 per cent. metallic lead (equivalent to 94·8 per cent. lead sulphide) and about ·2 dwt. gold and 42 dwt. silver per ton.

Of the considerable number of quartz veins found in the area, only one, known as "D Reef," shows any values on the surface, and although most of the gold from this could be extracted by fine grinding and amalgamation, further work is required before any reliable estimate of the value of the reef as a whole can be made.

Placers are being worked in the rivers Magamba, Msangama (and one of its tributaries) and Mpanda, from which 193 oz. bullion were extracted in 1937. No large-scale alluvial deposits, however, appear to be likely to occur in this area. A number of other occurrences of gold are known in the area which indicate that possibilities exist of the field extending to the north-west, to the east, and to the south-east, the zone of contact between the granite and the Basement Complex being the most likely region for further prospecting.

TRINIDAD

The following information regarding the petroleum and allied industries of Trinidad has been forwarded by the Inspector of Mines and Petroleum Technologist, Trinidad.

Petroleum, etc.—The production of crude oil in the Colony for the quarter ended June 30, 1939, was 4,789,659 barrels, this being an increase of 10·58 per cent. on the figure for the same period of the year 1938.

The crude oil was produced from the following fields: Barrackpore, Brighton, Cedros, Coora, Fyzabad, Guayaguayare, Lizard Springs, Los Bajos, Palo Seco, Parry Lands, Penal, Point Fortin, Tabaquite, and Vessigny.

The following table shows the quantities of petroleum and its products exported during the quarter ended June 30, 1939.

Exports of Petroleum, etc., April-June 1939

(*Imperial gallons*)

Crude oil	2,454,599
Fuel oil	91,786,747
Gas oil	2,848,372
Lubricating oil	508
Kerosene	1,037,550
Motor spirit	46,218,526
Road oil	286,002

Asphalt.—The total quantity of asphalt mined during the quarter under review amounted to 36,581 tons.

UGANDA

The Annual Report of the Geological Survey for the year ended December 31, 1938, is the last to be issued under the directorship of Mr. E. J. Wayland, C.B.E., who has now retired after twenty years service as Director.

Although by no means lavishly endowed with mineral wealth, Uganda is now enjoying the advantages of a growing mining industry, the value of her mineral exports in 1938 having reached £226,631, a total which is mainly due to gold and cassiterite. The report states that the recovery of minerals followed much the same lines as in previous years. In the south-west the Buhwezu district still contributed the major portion of the Protectorate's gold output and showed every sign of maintaining its level for some time to come. Lode gold was produced from Kanyambogo in this area and it appears that this neighbourhood will repay prospecting when a road has been constructed to reach it.

At Busia, near the Kenya-Uganda border, the Borderland property produced a steady output of gold from opencast workings and it was found possible to treat much of the laterite. A cross-cut at 178 ft. encountered several workable veins and it is hoped that driving along these will shortly be commenced. Further discoveries of auriferous lodes were made to the north of the River Kami in the Busia district and the area was closed to prospecting. One auriferous vein was discovered by a Geological Survey officer by means of a resistivity survey, a method which has been of great value in determining the position of the quartz in this vicinity. A report is shortly to be published on the closed area, which will then be opened to tenders.

The output of cassiterite continued to expand. The production of tantalite was less owing to the fall in the price realised, the fact that the tantalum content of many of the Uganda ores is not particularly high, and the lack of persistency of the lodes. It is hoped, however, that deposits of high grade will be found in Buhwezu, where heavy mineral concentrates, more particularly from the alluvial deposits of the Jemubi river, and even near its source at the foot of an escarpment, have been proved to contain much tantalite with a Ta_2O_5 content of 60 per cent.

A small quantity of wolfram was again exported and, for the first time, half a ton of bismutite, the natural bismuth carbonate. Judged by the surface indications, the wolfram lodes are considered promising and are to be

explored by means of adits driven into the steep Kigezi hillsides.

Considerable progress has been made in the prospection of the Lake Albert area for oil by the African and European Development Company. The Waki dome was proved by over 7,000 ft. of prospecting drilling. A deep drilling rig was set up over the centre of the structure and a depth of over 3,000 ft. had been reached by the end of the year. The beds met with were mainly shales and mudstones with some arenaceous strata towards the base.

Fifty-two tons of asbestos were produced from West Nile for the purpose of insulation ; this is purely a local enterprise and the material is too poor to warrant export. (Presumably this is the anthophyllite previously described from West Nile Province.)

Towards the end of 1937 lumps of an unusual mineral as much as 6 in. across were brought to the Survey from a locality 7 miles S.S.W. of Kagade on the Hoima—Fort Portal road. Chemical analysis and mineralogical examination of the material at the Imperial Institute showed it to be euxenite, a complex columbate and titanate of uranium and rare-earth metals. The site of the alleged occurrence was later examined several times by an officer of the Survey in company with the African prospector who made the discovery, but the report states that no euxenite, not even small fragments, were seen either *in situ* or in the soil and detritus about the mass. The euxenite probably occurred along the edge of a quartz mass surrounded by granite. [The Imperial Institute has since been informed by the proprietor of the deposit that he is now in a position to offer euxenite in ton lots.]

Some time ago a large quartz crystal suitable for piezo-electric use was obtained from the alluvial gold workings of Buhwezu. An officer of the Survey working on the alluvial gold deposits of this district also examined the quartz. He reports that the quartz crystals and pebbles are often water-clear and free from inclusions, and the material might be of use for the manufacture of fused silica. Most of the crystals are small and show signs of optical twinning, so that the great majority of them cannot be used for piezo-electric purposes. No other crystals having the qualities necessary for piezo-electric use were found.

The first diamond to be found in Uganda was discovered in 1938 in a sluice-box during the recovery of gold from alluvial workings in Buhwezu. It is a well-formed crystal, transparent and practically colourless, and weighs about 0·25 metric carats.

ABSTRACTS AND NOTES

Iron-ore Mining in Canada.—In July of this year work at the New Helen Mine, Michipicoten, Ontario, reached the production stage, and so for the first time since 1923 iron-ore mining has started again in Canada. Mining will be assisted by the Ontario Iron Ore Bounty Act, which, for a period of 10 years from January 1, 1939, provides a bounty of 2 cents per unit of iron to be paid to producers for ores delivered to blast furnaces. The New Helen Mine is situated 8½ miles north-east of Michipicoten Harbour on the north-east shore of Lake Superior, and is a successor to the Helen Mine, which has been the largest iron mine in Canada, having produced 2,823,369 tons of ore before the deposit was exhausted in 1918. It lies in the Michipicoten Iron Ranges, the natural extension of the great iron-ore district on the southern side of Lake Superior, which last year accounted for 73 per cent. of the production of iron ores in the United States.

The Helen Mine worked a deposit of limonite formed by some process of alteration of a much larger body of siderite which is now to be worked. During the War, when the limonite was nearing exhaustion, the siderite was explored and proved to be a tabular body 1,600 ft. long and 145 to 225 ft. wide, extending to a depth of at least 2,400 ft. It was estimated that there were nearly 100 million tons of ore above the 1,800 ft. level. Plans were made for the mining and sintering of the ore, but, with the collapse of the industry in Canada after the War, these did not materialise.

The new mine is being worked by Algoma Properties Ltd., a subsidiary of the Algoma Steel Corporation of Sault Sainte Marie, and the ore will be mined from an open pit until a depth of 200 ft. is reached. It is estimated that the deposit to be mined contains ore reserves of 60 million tons. The initial capacity of mining operations is expected to be 450,000 tons annually, which will yield about 300,000 tons of sintered ore with an iron content of about 50 per cent. A sintering plant is being erected at the village of Wawa, 2½ miles from the mine, where the siderite ore, which contains 36 per cent. iron, 2 per cent. manganese, 0·017 per cent. phosphorus, 2·5 per cent. sulphur and 7 per cent. silica, will be converted to a nodulised oxide ore with 50 per cent. iron, 2½ to 3 per cent. manganese, 0·03 per cent. phosphorus, and an appreciable content of lime and magnesia, which will assist fluxing in the blast furnace. Sintering of pyritic siderite ore was successfully carried out at the Magpie Mine in Michipicoten where a total of 1,250,000 tons was treated, and the experience gained

there will be utilised at the Wawa plant. While sintering increases the cost of production considerably, it must be realised that in the United States beneficiation of iron ores is becoming increasingly common as the reserves of directly saleable ores are in sight of exhaustion. On account of the appreciable manganese content of the ore, the Algoma Steel Corporation expects to use only half of the output, and to sell the remainder to other Canadian and American furnaces.

At Steeprock Lake, 4 miles north of Atikokan in north-western Ontario, the first high-grade bessemer haematite in Canada was discovered in March 1938 and hailed as the outstanding mining discovery of the year. Atikokan is situated on the Canadian National Railway 135 miles from Port Arthur on Lake Superior. The possibilities of this iron ore deposit had long been recognised, but it lies concealed beneath the lake and was only disclosed by a magnetic survey followed by an extensive programme of diamond drilling, done mainly in winter from the frozen surface of the lake. No less than 44 drill holes have intersected the haematite and indicate a deposit 3,500 to 4,000 ft. long, varying from at least 100 to 200 ft. in width, and proved to a depth of over 1,350 ft. The ore reserves must be at least 100 million tons. The main limb of the ore-body, which is about 2,000 ft. long, trends a little west of north with a steep dip to the west, and then continues westwards for a further 1,500 ft. or more with a steep dip to the south. The surface of the deposit appears to be very irregular, varying from 150 to 418 ft. below the lake surface. Geologically, the ore occurs in a series of Timiskaming sediments, lavas and ashes, and lies between brecciated limestones and greenstones cemented with ferriferous dolomite of igneous origin, and a pyritic ash rock, the haematite having apparently resulted from the oxidation of the ferriferous dolomite breccia. The ore contains on the average 58 per cent. iron, up to 0·07 per cent. phosphorus, 0·02 to 0·27 per cent. sulphur, 0·56 to 8 per cent. silica, and very little manganese.

Steep Rock Lake Iron Mines Limited, founded in April of this year, have announced plans for the mining of the deposit. A vertical shaft capable of handling 4,000 tons daily is to be sunk to a depth of 1,500 ft., and the ore body will be opened up by crosscuts at the 1,000 and 1,200 ft. levels. Production is expected to commence in 1940 at the rate of approximately 750,000 tons per annum.

The large-scale production of iron ore in Ontario will be of great importance to the Canadian iron and steel industry, which in recent years has been entirely dependent on iron ore imported from Newfoundland and the United States, annual

imports during the last four years having averaged about 1,400,000 tons.

New Zealand Mineral Production.—The following data regarding recent activity in the mineral industry has been supplied by the Under-Secretary of the Mines Department.

Auriferous Quartz Mining.—At the Martha Mine, Waihi, North Island, during the period March 12 to July 1, 1939, 60,552 tons of ore were treated, yielding 15,652 fine oz. of gold and 112,482 fine oz. of silver. In South Island the returns for the period April-June from the chief mines were as follows: Alexander Mine, 465 oz. of gold from 870 tons of quartz; Big River Mine, 310 oz. from 380 tons; Blackwater Mine, 5,794 oz. from 12,698 tons.

Gold Dredging.—The principal dredging area is in the West Coast District of South Island, and the returns for the period April-June 1939 were as follows:

Dredges.	Cubic Yardage Treated.	Gold Produced (*Troy oz.*).
Argo	140,700	492
Barrytown	579,000	1,927
Blackball Creek	—	702
Bundi	79,000	535
Gillespie's Beach	96,390	279
Grey River	1,074,880	3,229
Kanieri	662,000	3,925
Mataki	78,100	188
Mataki Junction	97,000	231
Mossy Creek	87,880	416
Nemona	112,200	406
New River	86,000	490
Okarito	—	195
Rimu	394,510	1,771
White's Electric	63,640	282
Worksop	—	319

In the Otago District 1,839 oz. were obtained from the Clutha dredge and 373 oz. from the Molyneux dredge during the same period.

Manganese.—Some 400 tons of high-grade manganese dioxide, estimated value £2,000, was mined during the first six months of 1939 from the property held by Mirandite Products Ltd., Christchurch, in Otau Parish, Block XIV, Wairoa Survey District, Auckland Province. Present indications suggest that reserves are not extensive.

Asbestos.—A deposit of chrysotile asbestos in the Upper Takaka District, South Island, is at present held by the Hume Pipe Company (Australia) Ltd. Since obtaining mining rights covering the deposit, the Company has had a geological and

magnetic survey carried out by the Department of Scientific and Industrial Research, which was followed up by extensive prospecting by means of trenching and driving, the results proving that asbestos is present in sufficient quantity to justify commercial exploitation. At present attention is concentrated on the completion of an access road to enable plant to be conveyed to the area. The Company has also completed arrangements for securing a crushing plant to process the asbestos and it should be possible to commence production without delay.

Petroleum.—Since the passing of the Petroleum Act, 1937, 52 licences to prospect for oil over a total area of 9,236 sq. miles have been issued. At least 50 geologists and geophysicists are employed by the operating companies and an exploratory bore is being sunk in the Gisborne District, North Island. This bore has reached a depth of about 4,500 ft.

During 1938 1,269 galls. of oil were collected from seepages from wells put down some years ago at Kotuku, South Island.

The output during 1938 from three wells at Moturoa, North Island, put down a few years ago by Moturoa Oil Wells Ltd., was 116,585 galls.

The Dominion's total production of petroleum up to the end of 1938 is estimated at 2,883,650 galls.

Magnesium, Magnesite and Dolomite.—The latest of the mineral monographs issued by the Mineral Resources Department is one on *Magnesium, Magnesite and Dolomite,* by J. Lumsden, B.Sc.(Edin.) (Royal 8vo, boards, 126 pp., price 2*s.* 6*d.*).

The work has been prepared on the same lines as others in the series of monographs on the mineral industry, embodying as it does an introductory section dealing with the production of magnesium from its raw materials, the uses of the metal, the production, treatment and non-metallurgical uses of magnesite and other magnesium minerals, and a section dealing with world resources of magnesium minerals of economic importance, particularly magnesite. Special emphasis is laid on Empire deposits, but those in foreign countries are by no means neglected, 29 countries in all being dealt with. In addition to descriptions of the deposits, chemical analyses and tables of production and trade statistics are included where possible. The monograph concludes with a selected list of references to technical literature.

Magnesium metal now occupies a position of great importance in the light metals industry. The commercial manufacture of the metal was for long a matter of great technical difficulty and Germany was the only manufacturer. Processes developed

during the past few years, however, have led to a greatly increased output, present annual production being, it is estimated, in the region of 25,000 tons, most of which is employed in the light metals industry. The expansion of the aircraft and automobile industries and the much more widespread application of the internal combustion engine in recent years have combined to bring about the rapid development of the light metals industry as a whole, and magnesium alloys, by reason of their lightness and rigidity, have taken a large part in this development.

Apart from its use in alloys, the most important modern use of magnesium is as a deoxidiser in metal refining on account of its strong chemical affinity for oxygen and nitrogen.

This is followed by a brief historical review of the rise of the industry in the most important producing countries and, although official statistical information regarding production is not always available, the estimates given for probable production in 1938 should prove of considerable value by reason of the large volume of semi-official and trade literature consulted in the preparation of this section.

Magnesite, which is the most important raw material for the manufacture of magnesium metal as well as being a very important refractory, is widely distributed in nature, though extensive deposits of economic importance are limited to some eight or nine countries. The various types found in nature, such as compact magnesite, crystalline magnesite and breunnerite, are described, together with their mode of occurrence and methods of working. The importance of the calcining process is stressed, the products, caustic calcined magnesite and dead-burned magnesite, being clearly distinguished. The former is employed in the manufacture of magnesium oxychloride cements and the latter in refractories and as the starting point in the manufacture of magnesium metal.

The introductory part of the monograph also includes sections on dolomite and naturally occurring magnesium salts, the uses for which these are particularly adapted being described.

Among Empire resources there are large deposits of magnesitic dolomite in Canada and extensive reserves of magnesite in India, the Union of South Africa and Australia being also producers. The principal foreign deposits are located in Germany (Austria), Greece, the United States, the U.S.S.R. and Manchuria. Dolomite, which is also a potential raw material for the manufacture of magnesium metal, is of very widespread occurrence and the United Kingdom is in a very fortunate position with respect to domestic reserves.

Magnesium, Magnesite, and Dolomite should prove of considerable value to those specially interested in light metals

or refractories, and the general reader will find in it much of interest regarding the world distribution and exploitation of magnesium minerals.

The Aranka Goldfield, British Guiana.—An auriferous area, some 276 sq. miles in extent, was surveyed by Dr. D. A. Bryn Davies in 1937 and is described in a recent Bulletin (No. 10) of the Geological Survey of British Guiana under the title of the " Aranka Goldfield, Cuyuni River." It includes the locally famous " Pigeon Island " goldfield and covers the greater part of the Aranka River drainage basin. The area lies to the south and south-west of the Lower and Middle Barama district surveyed by the same author and described in the previous issue of this BULLETIN (Part II, 1939).

Heavily forested and sparsely populated, the area is accessible by river boat from Bartica (distant 120 miles, with intervening falls and rapids) in the Essequibo estuary. In view of the nature of the goldfield, costly improvements in the means of communication are unlikely in the near future.

Occurring as alluvial, eluvial, and residual deposits, the gold appears to be related to the margin and the main body of a granite batholith, covering an area of over 100 sq. miles, which is intruded into metamorphosed acid and basic volcanic rocks. Both the plutonic and volcanic rocks are, in turn, intruded by dolerite dykes.

The topography of the district is directly related to the occurrence of these rocks; the granite giving rise to low undulating country, the acid to intermediate volcanic rocks weathering still further to produce flat, swampy areas, and the basic intrusive rocks giving rise to rugged mountainous country.

The structure of the Aranka district may be regarded, broadly, as one of regional isoclinal folding, the axes of which change from N.W.-S.E. to N.E.-S.W.

The Aranka goldfield was discovered in 1912 when a strike was made in a tributary of the Arangoy, the district being known as Pigeon Island. Later, a better find was made in the Sir Walter Creek, about 4 miles to the west of the original strike, and at one time 5,000 men were stated to be working on the field and 6,000 oz. of gold to have been recovered by primitive methods.

Since 1923, the possibility of larger-scale exploitation by more highly mechanical means has attracted a number of companies and engineers to this field, which may be considered according to a number of well-defined districts.

Sir Walter District.—This includes the country around the lower reaches of the Sir Walter and Lady Walter creeks and

the Aranka river between the mouth of Sir Walter Creek and Blackwater Creek. Here the gold occurs in residual, eluvial, river-terrace and recent alluvial deposits. The eluvial deposits consist of a gravel of quartz and laterite, rather thicker down the slopes than on the summits of the hills. These, it is believed, could be worked by some form of hydraulic mining. In this region an area of 120 acres is estimated to contain a million cu. yds. averaging $1.28 per cu. yd. of which 62 to 79 cents is recoverable, according to the method of extraction used. River terrace deposits are found in a number of places, but the only ones of any importance are those occurring a few feet (at their base) above the river flats on the right bank of Sir Walter Creek near Horne's camp. These consist of reddish clayey sand averaging 30 cents per cu. yd., but the lowermost layer, in which the gold values are concentrated up to $1.90 per cu. yd., has the appearance of a fine gravel. Many of the recent alluvial deposits of the small flats of the creeks have been thoroughly worked in the past, though small-scale payable areas, suitable for the small worker, still remain.

The possibility has also been investigated of dredging the Aranka river and the Sir Walter and Lady Walter Creeks, which together may contain some 6 million cu. yds. in an area of 400 acres, of which 675,000 cu. yds. averages 61 cents.

Upper Aranka and West Fork District.—The Aranka river follows quite closely the important granite-volcanic contact, but the river alluvials themselves are disappointing in gold values. A number of the tributaries and terraces, however, contain auriferous deposits which might be of interest to the small worker. No important deposits have been found in the West Fork Creek district, though some of the small-scale occurrences appear to warrant further prospecting.

Sowarri Hill, Raskasa, Unity and Success Creeks.—The deposits here are well within the granite batholith, but again, are unlikely to be of interest to large companies.

Old Pigeon Island and Upper Arangoy.—Other sedimentary occurrences of gold are found in various places in these districts. Lack of water in some cases has militated against their more intensive prospecting, but some might be profitably worked with a portable pump.

Adjacent Areas.—A number of other deposits, both working and abandoned, occur, but these have not been examined by the Survey.

The present report, in addition to including an account of a short visit to the same field by the Director of the Survey, also contains a number of maps illustrating the location and geology of the goldfield.

Natal Ilmenite Sands.—The fact that a sample of black beach sand sent to the Imperial Institute from near Durban proved to contain some 40 per cent. of ilmenite prompted an inquiry into the commercial possibilities of the beach sands in this vicinity.

From information received, however, principally through the kindness of the Director of the Geological Survey of the Union of South Africa, it would appear that the deposits of ilmenite-bearing sands on the Natal coast have little commercial possibilities. Although many analyses of these sands have been carried out from time to time and some very high ilmenite contents have been recorded, these results are not representative of the beach deposits as a whole, which, from investigations carried out by the South African Geological Survey, have nowhere been found to contain more than 1·5 per cent. of ilmenite.

In a sample examined by F. C. Partridge, which contained 1·47 per cent. ilmenite, 0·07 per cent. leucoxene and 0·03 per cent. rutile, it was found that nearly 97 per cent. of the amount of these titanium minerals was contained in the finer portion of the sand, and that if the sand coarser than 0·25 mm. was removed by sieving, the ilmenite fraction of the residue was increased to about 3·5 per cent. Although the potential value of the sands is thus increased, their exploitation in competition with existing sources of much higher grade material from other parts of the world would be difficult. Furthermore, the deposits of naturally concentrated material are not believed to be numerous or extensive and mechanical separation of the ilmenite is rendered difficult in many places by the presence of magnetic garnet and other minerals of fairly high magnetic susceptibility.

Quartz-Crystals for Tele-communications work.—The value of special quartz crystals for piezo-electric purposes has been the subject of an article in this BULLETIN (1938, **36,** No. 2), and recently another comprehensive account has appeared in the *Post Office Electrical Engineers' Journal* (1939, **31,** Pt. 4; **32,** Pts. 1 and 2).

An interesting but obstructive feature of the work of preparing the quartz plates for Post Office telecommunication circuits has been the phenomenon of electrical twinning. This takes the form of zones which possess no obvious crystallographic orientation and under stress generate charges of opposite sign to the remainder of the crystal. The effect upon a plate cut from such a crystal is that two charges of unequal sign are produced under stress by the twinned and normal portions and result in diminished or even zero piezo-electric efficiency. Etching with hydrofluoric acid reveals the twinning as patches

of more intense corrosion and also by curvilinear triangular pits.

With Brazilian crystals experience has shown that the most common form of twinning is a combination of the electrical and optical types; pure electrical twinning is less common, optical twinning exceptional, and totally untwinned specimens so rare as to constitute museum exhibits.

To produce primary or Z-slabs from the quartz crystals rapidly and accurately a high-precision cutting machine was designed by the Post Office, and the crystals, correctly mounted in plaster of Paris, are sectioned by a diamond-charged disc rotating on the machine at 1,500 r.p.m. Normally the primary sections, after being proved reasonably free from twinning by means of a polariscope and etching reagents, are trued up by grinding on fixed and rotary plates. It is an essential condition for the second stage of cutting that these slabs should have their transverse faces precisely normal to the principal crystallographic axis of the crystal (the " C " or " Z " axis), and to ensure this, each slab, which is received from the cutting machine accurate to within some $\pm$ 0°30′, is ground to the correct orientation.

The check employed upon the accuracy of grinding is the interference figure known as Airy's spirals, obtained by throwing the light from a sodium lamp through the slab lying on a glass slip from which reflection takes place back through the quartz into an analyser and eyepiece. This results in the same effect as two slabs of right-hand and left-hand quartz mounted on one another. The limits within which a perfect spirals figure is obtained is said to be within $\pm$ 0°5′ of the Z-axis, but it might be pointed out that if the uniaxial interference figure was employed even greater accuracy could be obtained.

The second stage of cutting, namely the development of the X- and Y-type plates, is done on the Z-slabs and gives a number of rectangular plates which are ground to the specified thickness in sets of four. A regular system of diagonally interchanging members of the set is used to eliminate the taper in thickness imposed by the cutting operation.

For the other two dimensions the plates are first edge-ground in sets of as many as 64, cemented into a solid block with ceresin wax. The final frequency adjustment is done by grinding each plate individually and measuring its resonance periodically until the correct figure is arrived at. The finished resonators are then gold plated by the sputtering process.

The degree of precision demanded is shown by the fact that the plates must be parallel within a tolerance of 0·0025 mm., the length tolerance being 0·005 mm. and the breadth

tolerance 0·001 mm. The plates so far employed as resonators have been of the order of 41 × 21 × 0·7 mm.

The Havelock Asbestos Mine, Swaziland.—Chrysotile asbestos has been worked in the Transvaal since the beginning of the century and for most of this period the New Amianthus Mine of New Amianthus Mines Ltd., a subsidiary of Turner & Newall Ltd., has been the leading producer. Recently this mine has become exhausted and its place is being taken by the new Havelock Mine in Swaziland. The history of the enterprise together with a description of the mine are summarised in the *South African Mining Year Book* (1938-9, pp. 43-47) and the *South African Mining and Engineering Journal* (May 6, 1939, pp. 289-294).

The Havelock Mine is situated about 12 miles south-south-east of Barberton, 10 miles from Pigg's Peak and about 50 miles from M'babane, the capital of Swaziland. Although reports of mineral occurrences in this area had been current for a long time, it was not until after the Great War that the existence of asbestos here on a very large scale became known. In 1928 and 1929 this area was thoroughly prospected and passed through the hands of various syndicates in Johannesburg. During the last eight months of 1929 the prospecting campaign was intensified and then, in spite of the trade depression, Messrs. Turner & Newell purchased 100 base metal claims for £240,000, which was said to be the largest amount ever paid in South Africa for a base mineral prospect. These claims, which now comprise the Havelock Mine, are laid out in a regular block approximately 5,000 ft. by 1,200 ft., the long side of the area running more or less north and south across the Tutuz River, which divides the mine into a western section and an eastern section. In 1929 the approach to this isolated spot was through some of the wildest country to be found anywhere in the Union or Swaziland.

Seven years later, when the New Amianthus Mine at Kaapsche Hoop was almost completely exhausted, it became necessary to prepare the Havelock Mine for production, and serious work commenced in April 1937 following upon a very heavy rainy season. It was first necessary to construct an all-weather road from the railhead at Hectorspruit to the mine and the Transvaal and Swaziland Governments co-operated with the mine owners to provide a highway for a total distance of 55 miles to Pigg's Peak, the last 12 miles from Pigg's Peak to the mine over the most difficult country being built by the mine owners. Modern houses fitted with every convenience were then built for the staff. A road is also under construction from the Barberton side.

Rapid development work has been carried out since

September 1937, following upon the installation of compressed air equipment. Most of the fibre occurs in a soft green massive serpentine which has a continuous strike of 4,500 ft. with an average width of 110 ft. and which dips at about 50°. There are innumerable intersecting cross-fibre veins of chrysotile which often reach an appreciable length and in some cases 1½ in. in thickness. This ore body is overlain by other serpentine and chert. Mining is to be carried on both by quarrying operations and by stoping from the third level. Before quarrying operations can commence, however, it will be necessary to remove no less than 4 million tons of wall rock and overburden. All the ore quarried will be gravitated to the shaft loading pocket through winzes sunk in the ore-body and which are connected with the main haulage level. In this way the handling of ore in the quarry will be reduced to a minimum. The special method of stoping to be used is that which has been evolved and used with success at the Shabanie Mine; it is a combination of shrinkage stoping and top slicing which enables the ore to be sorted underground. Some 50 to 60 per cent. of waste can thus be removed and used for stope filling, all the waste rock from subsequent treatment being also returned for this purpose. By this method mining costs have been brought to the low figure of about 1s. 6*d*. per ton.

By May 1939 a main shaft had been sunk at an incline of 40° for a distance of 850 ft. After encountering very bad ground in the first 200 ft., owing to the great depth to which the serpentine in the footwall of the ore-body has been decomposed, it was necessary to employ the François cementation process to control the ground movement. A drainage adit had been driven a total distance of 3,800 ft. and connected with the main shaft. Development work resulted in opening up for stoping 14 million tons of reserves, all of which was situated above the horizon of the drainage adit.

It is estimated that the initial production will amount to 24,000 tons of high-grade fibre yearly, an amount nearly equal to the total production of the Union in 1937. Four grades are to be produced: No. 1, spinning fibre; No. 2, spinning fibre; No. 3, shingle fibre; No. 4, shingle fibre.

Owing to the difficult country in which the mine is situated, a journey of 140 miles from the mine to Barberton *via* Hectorspruit and Pigg's Peak would be necessary if ordinary surface methods of transport were used and it was therefore decided to employ an aerial ropeway. This ropeway, which was brought into commission in October 1938, has a total length of 12·6 miles and is of the bi-cable type. Its outward capacity is 7½ tons of bagged asbestos per hour and its speed about 6 miles per hour. The terminal at Barberton is located in the South African Railway station reserve where the main storage

shed has space for 1,000 tons of bagged fibre in addition to storage for crude oil, coal, and general mining stores. From Barberton the asbestos will be railed to Lourenço Marques for export.

Recent reports indicate that production has now commenced.

Properties and Uses of Peat.—Peat covers a very large total area of the land surface of the world, and although it occurs most abundantly in cool humid regions, it is not confined to temperate zones, and is found occasionally even in the tropics. The possible utilisation of peat is a matter of importance and a considerable amount of work has been and is still being carried out, especially in Scotland. The present state of knowledge of the subject has recently been summarised by Dr. W. G. Ogg (*Chem. and Ind.*, 1939, **58**, 375-9).

Peat is composed almost entirely of plant residues. The nature of the processes involved in its formation is still a matter of dispute, although it is now generally agreed that these processes are partly chemical and partly microbiological.

There are two main types of peat, the lowmoor and moorland groups, which differ both in the nature of the original plants and in the degree of decomposition, and hence in physical properties and in chemical composition. The lowmoor type is usually formed where ground water rich in plant nutrients collects in hollows. When the reaction of this type is neutral or alkaline, it is termed "fen" and where the original vegetation has consisted largely of trees and shrubs, the term "carr" is applied. Both fen and carr occur in parts of Great Britain, especially in East Anglia.

Where the water is very poor in bases the peat formed is usually low in mineral matter content and intensely acid in reaction. This type is known as moorland or moss peat, of which there are several varieties. Moorland peat is of widespread occurrence in the Highlands of Scotland.

Since peat is formed from plant remains, its constituents are mainly organic, although there is always present a small amount of mineral matter derived from the plants. The usual range for the composition of the organic matter is as follows: carbon, 50 to 60 per cent.; hydrogen, 5 to 6 per cent.; oxygen, 34 to 36 per cent.; and nitrogen, 1 to 4 per cent. The composition of peat is so complex that it is not surprising that there is considerable lack of agreement regarding the actual compounds present. Odén and other early workers extracted peat with alkali and precipitated the alkaline solution with acid. This precipitate was then further subdivided by means of solvents and names given to the different fractions obtained.

Shreiner and Shorey isolated a large number of definite chemical compounds from this acid precipitate, but it seems probable that some at least of these were formed as the result of treatment with various chemical reagents.

Recently Waksman and his co-workers have done a considerable amount of work, by the use of selective solvents, hydrolysis, etc., on the proximate analysis of peats and soil humus. Although conclusions can only as yet be drawn in a very general way and the methods used require improvement, this work seems to have opened up a rational line of investigation.

The amount of mineral matter in peat is very small compared with that of the organic matter. The lowmoor types usually contain considerably more inorganic material, especially lime, than the moorland peats and consequently they have been more widely developed for agricultural purposes.

Peats naturally vary widely in properties, but they all contain a considerable amount of colloidal matter. They have a high water-holding capacity and a large proportion of the water can be removed by air-drying, after which the water-absorbing capacity is very much reduced. Peats vary in colour from yellow to black, and in texture they range from a fibrous spongy material to a soft slimy mass. The apparent specific gravity varies from about 10 lb. to 60 lb. per cu. ft. The calorific value of air-dried peat containing about 30 per cent. moisture is usually about 6,000 B.Th.U. per lb., but the calorific value of completely dry peat is considerably more. The thermal conductivity is very low. Peat also has the power of absorbing various ions, such as phosphorus, potash, ammonia, lime and magnesia from solution.

By detailed examination of peat layers, some idea of the types of vegetation from which it was formed can be obtained. Peat also acts as a collecting ground for dust, and amongst the constituents of this dust are the pollen grains of plants growing near the peat bog. These pollen grains possess chitinous walls which are very resistant to decomposition, and by microscopical examination, the kind of plant from which the pollen came can be recognised and the relative proportion of various species determined. In this way, by the examination of successive layers of a peat bog, a record can be obtained of the changes in vegetation, related to climatic changes, which have taken place during the formation of the peat. In addition, by the preservation of archæological remains in peat, these vegetational and climatic changes can be correlated with prehistoric datings. By comparing the types of pollen found in peat layers with those present in clay deposits laid down by the action of glacial melt-water, it is possible to arrive at

approximate dates for peat deposition and to determine very roughly the rate of formation of peat.

Peat has been employed locally as a fuel from time immemorial, although in the hand-cut and air-dried state its heating value is low. Briquettes made from peat are now being marketed, both for domestic and industrial purposes. Attempts have also been made to use peat fuel for making producer gas and to carbonise it to produce gas, charcoal, tar oils, etc. It has been used as an insulating material and as an absorbent and as a deodorant.

Peat is used for many purposes in connection with agriculture and horticulture, *e.g.*, as packing material for fruit and vegetables, for stable litter, as a mulch, as a source of organic matter, and in some compound chemical fertilisers.

Peat land can often be developed for agricultural use. Often the main requirement for the reclamation of fens is the provision of adequate drainage, but the reclamation of the moorland type is more difficult and, owing to the necessity for heavy applications of lime and fertilisers, is also much more expensive. Peats of both types can, however, be reclaimed and fair yields of certain crops obtained from them. Partial reclamation can sometimes be carried out to convert worthless moorland peat into fair quality pasture.

Although considerable progress has been made, the economic utilisation of large areas of peat land remains a problem still to be solved.

Superior Anti-knock Motor Spirit produced by Catalysis.— In recent years a progressive rise in compression ratios has been a feature of automobile engine design, and a more than proportionate increase has taken place in the anti-knock characteristics of motor spirit, as evidenced by the higher octane ratings. Whilst the addition of tetra ethyl lead is an adequate treatment for the lower grade fuels for road operation, such a procedure is inapplicable to aviation spirit.

Research into methods of producing these special fuels of high octane rating has hitherto proceeded along the two lines of synthesis and pyrolysis, but attention has lately been turned to catalytic methods and these are discussed in a recent paper by G. F. Fitzgerald (*Chem. Metall. Engng.*, 1939, No. 4, pp. 196-199). Two processes have so far appeared, the Houdry method of the Socony-Vacuum and Sun Oil companies, and that of the Universal Oil Products Co. Ltd., made public by Dr. Egloff. The former process has already made

great progress, and in addition to eleven plants for the United States, two plants have been ordered for French refineries.

The Houdry process operates normally on gas oil, which is charged to a continuous pipe-still *via* heat exchangers, and leaves the still at 900 to 1,000° F. for two or more catalyst towers. The catalyst is activated aluminium hydrosilicate, which apart from regeneration about every 30 minutes by an injection of air or steam to remove carbon deposit, gives practically unchanged yields after six months to a year of service. The catalyst towers are placed alternately on stream approximately every half-hour to enable the removal of carbon deposit from the catalyst to be effected.

The cracked product from the towers after passing through heat exchangers is fractionated in a column of conventional pattern where the residual gas oil is removed from the petrol. This residue, unlike that remaining in thermal cracking processes, is almost identical with the raw feed, and may be re-cycled or treated thermally. In the aggregate, the production of petrol by this dual cracking of gas oil approaches very closely to 90 per cent. of the charging stock, and the process is unique in that it functions on any type of raw material except, of course, straight-run petrol. The final product has a high lead-doping susceptibility and an octane number of 78 to 80 with excellent blending value. A commercial blend of 75 per cent. Houdry aviation spirit with 25 per cent. iso-octane and less than 3 c.c. of ethyl fluid per gallon is rated at 110 octane by the United States Army method of testing.

The Universal Oil Products Company, licensor of the famous Dubbs thermal cracking process, has patented a catalytic process which has a flow-sheet resembling that of the Houdry method but functions on a catalyst of silica impregnated with phosphoric anhydride, and a charging stock preferably of highly paraffinic gas oils. By running the charge from the pipe stills once through the catalysers and feeding the residue to a thermal cracking unit, maximum yields of 80 to 82 octane spirit are obtained. The catalyst towers are in pairs and are put into circuit alternately at intervals of about 30 minutes, so permitting of regeneration of the anhydride activity. By this means the life of the catalyst proves to be from three to four months.

The olefine gases produced in both processes are catalytically polymerised, in the Houdry process by means of the same catalyst as used in the main plant, and in the U.O.P. process by a sulphuric acid method employed for normal and isobutenic side products.

It may be reasonably forecast that the extensions of these

processes will further enlarge the supplies of high octane spirit and prove of prime importance to air commerce.

Coal Metamorphism in Colorado.—The mode of origin of anthracite has proved a fascinating problem ever since the days of Strahan and Pollard's work in South Wales, and recently the well-known anthracites of the Butte Quadrangles in Colorado, U.S.A., have been examined by E. C. Dapples with the object of throwing further light on the subject (*Econ. Geol.*, 1939, **34**, No. 4, pp. 369-398).

Structurally the Anthracite—Crested Butte area consists of a cyclically-deposited succession of early Tertiary massive sandstones and shales with coal seams dipping gently in a south-westerly direction, and covering an area of some 200 sq. miles. This basic disposition is broken by a north-south monocline on the eastern margin of the field, a south-westerly trending syncline in the western area, and local arching of the strata around Mounts Carbon, Wheatstone, Axtell, and the Anthracite Range, which are laccolithic intrusions of porphyritic quartz-monzoite. No evidence of marked plasticity of strata indicative of deep-seated intrusion are said to exist in the shales and sandstones of the district, and the seams exhibit no distortion of banded constituents except in one small locality. It is apparent, therefore, that the intrusions occurred at relatively shallow depths, probably beneath about 6,700 ft. of early Tertiary strata.

The coal seams, twelve in number, occur in three basins, the Mount Carbon, Slate River Valley, and Floresta fields, and generally in the first-mentioned area they range from sub-bituminous to high-volatile bituminous types, and in the second from high-volatile bituminous grades to anthracites, while the last is restricted to anthracites. Anthracites, however, are found in all three fields, and are associated with the laccoliths in the Mount Carbon and Floresta districts and the north limb of the syncline in the Slate River Valley field.

Natural coke is found in two localities in the Floresta field associated with porphry intrusions, and in places presents a brecciated character. Examination of the structure of this coke reveals that a considerable degree of fragmentation has taken place, together with subsequent recementing of the fragments by coaly material rendered fluid by the heat from the porphyry intrusions. Vacuoles are also common throughout the coke.

The author concurs with the opinion that locally anthracitic types of coal are produced by contact metamorphism, but expresses uncertainty as to whether extensive anthracitisation of a seam or group of seams can be accomplished by pressure

alone; that is, without the aid of heat sufficient to volatilise the coal under atmospheric pressure.

Applying the results of Lovering's researches on heat conduction through dissimilar rocks, it transpires that in the vicinity of a porphyry apophysis 200 ft. wide, which has produced a coked zone 3 to 4 ft. wide in a seam in the Anthracite Range, the temperature attained by the coal substance at coking would appear to have been 460 to 500° C. The laboratory tests on the coking of two samples of a high-volatile bituminous coal from two mines in the area, revealed that at atmospheric pressure decomposition began at 350° C., and large vacuoles developed between 350° and 380° C., but the effect of the superincumbent load of strata would be to raise the temperature of coking and accordingly the temperatures as calculated by Lovering's curves are not excessive.

In the Ruby coal the temperature of anthracitisation as judged by the absence of waxes known to melt near 200° C. and of resins normally in-filling cells now empty yet uncrushed, is said to be about 350° C., and by estimating the weight of overlying strata and igneous intrusions a pressure of from 1,400 to 2,800 atmospheres is arrived at.

In other localities in these fields evidence is available apparently demonstrating that though heavy pressures were imposed on the coal seams, the lack of sedimentary cover to the igneous intrusion prevented the generation of the requisite temperature for anthracitisation. On the other hand evidence of coking of the seams where pressures were obviously small, points to the process of anthracitisation being due to an essential combination of both temperature and pressure.

In the Mount Carbon and Floresta fields the presence of igneous intrusions accounts for the temperature, and depth of sedimentary cover the pressure, requisite for the production of anthracite, but in the Slate River Valley field the seams are not effected by any but moderate folding, and igneous rocks are characteristically absent, yet anthracitic types of coal have been widely developed. The author ascribes this anthracite to tangential thrusting in the coal seams themselves and the accompanying generation of heat by intensive fracturing of the coal upon a minute scale.

BOOK REVIEWS

Books for review should be addressed to "The Editor," Bulletin of the Imperial Institute, South Kensington, London, S.W.7.

A SOURCE BOOK IN GEOLOGY. By Kirtley F. Mather, Ph.D., Sc.D., and Shirley L. Mason, Ph.D. Pp. xxii + 702, 9 × 6. (London: McGraw-Hill Publishing Co. Ltd., 1939.) Price 30*s*.

This volume is one of a series of "Source Books in the History of the Sciences," the aim of which is to present the most significant passages from the works of the most important contributors to the major sciences during the last three or four centuries. Organisation of the Advisory Board commenced in 1924 and the project has since been endorsed by leading American scientific associations including the American Philosophical Association and the American Association for the Advancement of Science. The period actually covered by this series is from the Renaissance to the end of the nineteenth century; in the present instance contributions originating since 1900 have not been considered, nor has the work of living geologists been included. The authors announce that in making their selection they have tried to keep in mind the needs of the reader interested in the historical development of the science of geology as well as the needs of the student who wants to secure first-hand information concerning the origin of the principles upon which he depends in his own research. They have also been guided by the probable availability of the material in the various libraries of the United States.

Passages from the works of more than 130 authors are arranged chronologically according to the dates of birth of the authors, a brief biographical note being given in each case. The styles of the original articles have been retained, and in most cases the original titles are used. All the extracts are in English, a number of special translations having been made. The fact that the book is intended for American readers, however, is evident in a certain bias shown towards American authors. It is well printed and well bound in the usual manner of this firm of publishers.

BUREAU D'ÉTUDES GÉOLOGIQUES ET MINIÈRES COLONIALES ANNUAIRE 1938-1939. Pp. 631, $8\frac{3}{4} \times 5\frac{1}{2}$. (Paris: Bureau d'Études Géologiques et Minières Coloniales, 1939.) Price Fr. 40.

The current issue of this useful and comprehensive "annuaire," which, it should be noted, deals with the two

years 1938 and 1939, is very similar in contents and general plan to its predecessors. Prior to the 1937 issue, it was published by the Comité d'Études Minières pour la France d'Outre-Mer, but in 1937 publication was taken over by the Bureau d'Études Géologiques et Minières Coloniales. As in the 1937 issue there are sections dealing with official administrative bodies, mining organisations, learned societies, colonial mining legislation, mineral statistics and prices, mining companies, manufacturers of mining machinery, and transport companies in the French overseas possessions. The very useful large section on mining companies is classified alphabetically by countries and by commodities, and gives the address, date of foundation, capitalisation, directors and mineral properties of each company.

The new edition is much larger than the old and includes a number of additional administrative and mining organisations, together with a new bibliography of geological and mining publications, mainly comprising those quoted in the *Chronique des Mines Coloniale* for 1938.

This latest annual is bound in the familiar blue paper, but an innovation is the use of coloured paper for several of the sections in order to facilitate ready reference.

QUELQUES REMARQUES SUR LES MINES MÉTALLIQUES TROPICALES ET EN PARTICULIER SUR LES MINES D'OR, par Robert Sauze. UNE MÉTHODE NOUVELLE EN MÉTALLURGIE AURIFÈRE : L'AMALGAMATION SOUS PRESSION PAR UTILISATION DE LA TENSION SUPERFICIELLE, par Georges Passelecq. Publications du Bureau d'Études Géologiques et Minières Coloniales, No. 13. Pp. 33, 10 × 6½. (Paris: Bureau d'Études Géologiques et Minières Coloniales, 1939.) Price Fr. 10.

Issued on the occasion of a grant of 100 million francs in aid of gold exploration and exploitation, the first of these two papers is a general causerie addressed to young engineers in order to stimulate the colonial outlook and a taste for the outposts of Empire. The essay, which is based on the author's experience in the French Colonial Empire, reviews some general and specific aspects of prospecting, milling and metallurgy, particularly of gold.

The second paper describes the principles and technique of what is known as "Pressure Amalgamation" by the de Phily amalgamation process and the Ramsay mercury separator. The de Phily process, which was announced in 1935, has been the subject of research at the Royal School of Mines and at a private laboratory in Lambeth, and the results of this work, as applied solely to dry crushed ores, appeared in the *Mining*

Magazine for August 1938 together with an outline of the fundamental principles and the technique employed. The present paper, in addition to covering the same ground, proceeds to describe the application of the process to sedimentary deposits and other ores which are in the wet condition.

The process of pressure amalgamation consists essentially in the feeding of finely crushed ore into a trough of mercury in which rotates a horizontal cylinder equipped with vertical discs. The particles are held against the discs by surface tension and are carried down into the mercury as they rotate, being subjected to a pressure of up to 20 lb. per sq. in. at the lowest point of immersion. At the point where the discs emerge from the surface of the mercury, the sand is left behind and decants over a weir. The heavy gold amalgam falls through the mercury to the bottom of the trough where it is collected and tapped off, the gold then being recovered by the usual methods. Advantages claimed for the method are that it does not involve the use of water, that it works rapidly and high recoveries are possible, and that it is suitable for ores which contain cyanicides or constituents which militate against the use of flotation, barrel-amalgamation, or gravity methods of separation.

In the wet process an essentially similar apparatus is used, but, in this case, the mercury in the trough is covered to a suitable depth with water, owing to the fact that alluvial materials which are merely damp have less fluidity than when either in the completely dry or in the thoroughly wet condition. In this case also there is provision for the extraction of the tailings sand by an elevator.

In the all-dry process the question of demercurisation of the tailings is important, and it is for this purpose that the Ramsay air-separator has been designed to work in collaboration with the amalgamator. When water is present the question of demercurisation does not arise as only a negligible quantity of mercury is carried off with the tailings.

FIRST REPORT ON REFRACTORY MATERIALS. The Iron and Steel Institute, Special Report No. 26. Pp. vi + 478, $8\frac{1}{2} \times 5\frac{1}{4}$. (London: The Iron and Steel Institute, 1939.) Price 16*s*.

The Iron and Steel Institute in this Special Report, the latest in the series, has co-operated with the British Refractories Research Association, the joint panel being responsible for an extremely informative volume. The work is divided into two main parts, the first dealing with steelworks refractories and the second with blast-furnace refractories.

The section on steelworks refractories opens with a concise introduction to the subject by Dr. T. Swinden, the Chairman of the Joint Research Committee, in which the general scope of the work undertaken is described, together with a review of the projected programme of future research.

Refractories used in the basic open-hearth furnace are dealt with, commencing with a very full description of the furnace and the conditions to be observed in the selection of the most suitable refractory materials for the construction of the various parts, and proceeding to a consideration of modifications in standard practice in design and operation. Amongst the various refractory materials described are silica, magnesite, chrome, chrome-magnesite, dolomite, and forsterite, their various properties and uses being described in detail. Of considerable value to the industry should be the results of extensive research on the effect of furnace design on the life of the linings.

Subsequent sections of this part of the book deal principally with investigations on the use of particular refractories such as composite chrome refractories, chrome-magnesite-dolomite mixtures, chrome-magnesite bricks, synthetic spinels and silica bricks. The section on steelworks refractories includes a most useful table giving a proposed standard nomenclature of the various parts of the open-hearth steel furnace together with a line-diagram indicating the various parts mentioned.

The second part of the report deals with blast-furnace refractories and includes the results of a large number of experiments carried out on furnaces in normal operation. Arrangements were made with the furnace owners for the supply of samples of linings when the furnaces were dismantled and the results of examination of these samples are given, principally in tabular form. The action of slags on refractory materials has also been studied, the results being illustrated in many cases by means of photomicrographs. Another subject of investigation was the action of alkaline vapours on refractory materials and here also some interesting results were obtained.

Jointing cements are important in blast-furnace construction and a considerable amount of research has been devoted to this subject. The various types of cements in general use are described, and their relative merits discussed in some detail.

The section concludes with a survey of the technique employed in carrying out the refractoriness-under-load test.

Prominent features of the report are the volume of tabular matter showing experimental results, the extensive use of explanatory diagrams, and the very full bibliography of

technical literature at the end of each section, comprising in one case 903 items.

The nature of the report is such that the preparation of a satisfactory index would present considerable difficulties and no attempt has been made to do so. Each section, however, is preceded by a very comprehensive table of contents, thus making for easy and rapid reference.

The report, which is the combined work of a large number of competent authorities on refractory materials and technique, is a highly important contribution to the literature on these subjects.

HANDBOOK OF MICA. By Ramani Ranjan Chowdhury. Pp. xvi + 344, $8\frac{1}{2} \times 5\frac{1}{2}$. (Calcutta: Thacker, Spink & Co. (1933) Ltd.; London: W. Thacker & Co., 1939.) Price 22*s*. 6*d*.

A book entitled *India Mica*, Vol. 1, by the same author, was reviewed in this BULLETIN, 1933, **31**, 624, but instead of proceeding with Vol. 2 as originally intended, he has undertaken a more comprehensive review of the whole subject within the compass of a single volume.

Such a task is one of considerable magnitude, and the resulting volume must necessarily be largely a compilation from published work, but in the present case the volume consists largely of a succession of quotations from previously published works strung together in a rather haphazard way without adequate digestion. It is therefore full of repetition and does not give a connected account of the subject. Nevertheless, this handbook contains a great deal of information.

The book comprises six parts, each further divided into several chapters. Part I deals with the geology and with the physical and chemical characteristics of mica; Part II with production, prospecting, development, mining and economics; Part III with the occurrence of mica in India and other countries; Part IV with the commercial preparation of the mineral. Part V, which deals with the utilisation of mica and mica products, includes a chapter on the electrical uses of mica contributed by Professor P. N. Ghosh, of Calcutta University College of Science. The final part deals with the marketing of mica, and is followed by a number of appendices relating to such aspects of the mica industry as the American code, warehousing charges, tariffs, standard specifications, prices and production.

Unfortunately, on the rare occasions where the author has summarised existing information, inaccuracies have been

allowed to creep in. Thus, for example, on p. 166 we find "*The Leysdorp mica fields*—Mica belt in the Union occurs along the Ulugeru mountains in the Morogoru district in the low country of the North-Eastern Transvaal," a statement which besides containing several misspellings involves both geographical and topographical confusion. There are frequent typographical errors in the book, and, as in his *India Mica*, Vol. I, the author uses "chlorate" schist for chlorite schist.

Like its predecessor the book is primarily intended for Indian mica-producers and dealers, and makes little or no contribution to the information already available elsewhere on mica.

MONOPOLY AND COMPETITION IN THE ENGLISH COAL TRADE, 1550-1850. By Paul M. Sweezy. Harvard Economic Studies, Volume LXIII. Pp. xii + 186, $8\frac{1}{2} \times 5\frac{3}{4}$. (Cambridge, Mass., U.S.A.: Harvard University Press; London: Humphrey Milford, Oxford University Press, 1938.) Price 10s. 6*d.*

The Harvard Economic Studies have established a high reputation for accuracy and sagacity, and this addition to the series fully maintains the excellent standard.

The study is essentially a local one being concerned with the ways and means of marketing coal on the Tyne, Wear and Tees in the sixteenth, seventeenth, eighteenth and nineteenth centuries. That an acute degree of competition existed is evidenced by the many attempts, both local and parliamentary, which were made to introduce or impose some measure of regulation upon the business of selling coal for the London market.

From the earliest days of the Coal Trade in the North of England the author traces in twelve chapters the growth and decay of the Company of Hostmen in Newcastle upon Tyne, which was chartered in 1600 and, after functioning as a guild of coal mine owners and then of merchants, became submerged after the Civil War by a powerful combination of local mine owners known as the Grand Allies, who at one time controlled 60 per cent. of the Tyneside coal output.

The bulk of the volume is devoted to tracing the conflict amongst mine owners, shippers and London merchants, and particularly the collusion of the owners to adjust the output and sales of coal known as the Limitation of the Vend. This was a monopolistic combination to fix prices and apportion sales probably in action from about 1771 until 1845, when during a severe labour strike the members grossly failed to adhere to their respective sales quotas and the mutual aid society had to be abandoned in May of that year. The coal

trade then reverted to a " free " basis and the resulting drop in coal prices brought ruin on colliery proprietors and bankers alike.

The book makes entertaining reading and reveals the wealth of information available in the invaluable records of the North of England Institute of Mining and Mechanical Engineers.

THE NATURE AND ORIGIN OF COAL AND COAL SEAMS. By A. Raistrick, Ph.D., M.Sc., M.I.Min.E., F.G.S., and C. E. Marshall, Ph.D., B.Sc., F.G.S. Pp. 282, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: The English Universities Press, Ltd., 1939.) Price 12*s*. 6*d*.

With the appearance of this general work, the rapidly growing literature on coal has been increased in a somewhat unusual manner since it is calculated to afford a link between scientific research and everyday practice. The topics considered are not in themselves novel, but the authors are to be complimented upon their pleasing presentation of the modern interpretations of coal morphology and genesis, and the excellent effort which has been made to compress such a variety of subjects into so limited a compass.

Initially, the Coal Measures sediments and conditions of deposition are considered, then in chapters II to VI the authors treat of the coal seams as found to-day, their origin as swamps infilling with vegetable débris, the mode of formation of split seams, seam washouts and faulting in coal seams. This is a commendable summary, but exception may be taken to the statement (p. 37) that the " brasses " found in coal seams are commonly marcasite, a form of iron sulphide prone to rapid oxidation and thus likely to be responsible for spontaneous combustion in mines. It should be noted, in this connection, that the presence of marcasite in coal is a rarity, and the superior rate of oxidation over iron pyrites has not been definitely established.

A much debated and highly important question, the correlation of seams, forms the thesis of chapter VII, and the various methods, palæontological, stratigraphical and palæobotanical are discussed. In the ensuing chapter the economic products of the coal measures are dealt with in a somewhat irrelevant manner, and amongst other points it may be mentioned that good-quality ganisters (p. 139) seldom fall below 97 per cent. silica and never down to 87 per cent., and that the effect upon plasticity of high alkali content in clays is doubtful. Again, the use of Coal Measures period sandstones for building purposes, other than locally and particularly in London, is exceptional compared with the vast amount of other stone employed, such as that from Portland.

On the subjects of Coal Measure flora (chapter IX), the petrology of coal, the chemical constitution of coal, rank in coal, and the igneous alteration of coal seams (chapters X to XII), the authors are more at home and provide information in keeping with the quality of the first portion of the book.

A valuable bibliography, and appendices on the preparation of coal for petrographic examination, the nomenclature of coal petrology, and the classification of coal according to rank, together with a subject index, conclude a volume characterised by an entertaining prose style and a wealth of first-rate plates and line diagrams.

Coke and By-Products Manufacture. By Major E. C. Dixon, A.M.I.Chem.E. Pp. vii + 176, $7\frac{3}{4} \times 5\frac{1}{4}$. (London: Charles Griffin & Co., Ltd., 1939.) Price 6s.

Despite the wealth of literature which exists on the subject of coke manufacture, there has long been room for a concise but authoritative textbook applicable to the needs of the student of coke-oven technology. Major Dixon's breadth of experience, both as a practising plant manager in the North of England and as a lecturer, are reflected in his text-book, which in eleven short chapters covers the subject of coking from the composition and cleaning of the raw coal to the design and operation of coke-oven plant.

The brief but excellent conspectus of the growth of the coking industry up to the present day given in the introductory section is followed by a short chapter dealing with the chemical and petrological constitution of coal, and with some of the impurities more generally associated with it, and this is followed up in the second chapter by some notes on coal-cleaning processes.

A certain amount of repetition is present in the succeeding three chapters which are devoted to preliminary treatment and carbonisation of coal, coke ovens and coke production; in fact, chapters three and five might with advantage have been combined.

The remaining topics dealt with comprise the treatment and testing of coke-oven gas, the extraction and distillation of tar, the recovery of ammonia, and the recovery and purification of benzole. This completes the subject as far as direct coke-oven practice is concerned, but, in addition, two short chapters are included on steam-raising and the design and operation of coke-oven plant. In the chapter on steam-raising the author discusses boiler management, efficiency and power, and the laboratory testing of boiler water, while the final chapter is concerned with the choice of coking plant, location

of site, the laboratory control of coking operations, and the implications of the Factory Act, 1937.

The book is illustrated by a number of excellent line-diagrams, and has a useful index of subjects.

TANKER FREIGHT RATES AND TANKSHIP BUILDING. By Dr. T. Koopmans. Netherlands Economic Institute, No. 27. Pp. xii + 219, $9\frac{1}{2} \times 6\frac{1}{4}$. (Haarlem: De Erven F. Bohn N.V.; London: P. S. King & Son, Ltd., 1939.) Price hfl. 2.

The last three years have been a period of intensive tanker construction, particularly in the United Kingdom, where it may be said to have reached a peak with the launches of the 15,000 tons *Torinia* and *Thiara* from Tyneside yards. In all, out of a world's total of 1,731 tankers of over 1,000 tons gross and totalling 11,436,880 tons, the United Kingdom owns 435 of a total of 2,919,566 tons, and occupies a position premier even to the United States. Such pre-eminence engenders an extensive interest in the tanker industry and makes Dr. Koopmans' book doubly welcome in this country.

The volume consists of three parts devoted respectively to parties in the tanker freight market, tanker freight rates in times of prosperity and depression, and tanker freight rates and tankship building; with, in addition, summaries in English and Dutch, and eight appendixes mainly of a statistical nature.

A general introduction prefaces Part I, which surveys the present national disposition of tanker registrations, and the subject of tanker chartering by time period and voyage basis. The bulk of the work, Part II, is in six sections ("chapters" are not used) and is an investigation of the formation of freight rates on a quantitative basis as conditioned by supply and demand, the ruling factors normally approaching those of pure competitive trading and being characterised by marked inelasticity in periods of augmented demand for tank space.

In Part III the interplay of price rate levels and tankship building is reviewed, in addition to the function of the Tanker Pool in maintaining a remunerative level in tanker hire charges. That there is a rise and fall in tanker rates and the tonnage of the associated building programmes is not doubted, but the cyclical nature is not strikingly evident, it being, at present, influenced more largely by world political affairs.

The book is a valuable contribution to the statistical literature of shipping and makes a definite appeal to petroleum shippers.

CALCIUM SUPERPHOSPHATE AND COMPOUND FERTILISERS: THEIR CHEMISTRY AND MANUFACTURE. By P. Parrish, F.I.C., M.I.Chem.E., M.I.Gas E., F.I.I.A., and A. Ogilvie, M.I.Mech.E. Pp. xiv + 322, 9¾ × 7¼. (London: Hutchinson's Scientific and Technical Publications, 1939.) Price 35*s*.

The authors of this book published in 1927 a volume entitled *Artificial Fertilisers: Their Chemistry, Manufacture and Application*, which was noticed in this BULLETIN (1927, **25**, 475). The present work is essentially a new and up-to-date edition of this, under what the authors regard as a more apposite title, as the earlier book also dealt mainly with calcium superphosphate and other phosphatic fertilisers.

This work follows the same general lines as before, starting with a survey of the present position of the fertiliser industry in this country. The authors point out that their earlier forecasts regarding the direction which the organisation of the superphosphate industry must take have been closely followed. There have been, as they suggested, amalgamations of small works with, for the most part, discontinuance of separate manufacture, and the establishment of large plants manufacturing from 75,000 to 100,000 tons of calcium superphosphate per year with modern sulphuric acid plants attached.

The next chapter surveys the world's supplies of mineral phosphates, both the old-established sources and the newer ones such as Russian Kola phosphate being considered, and includes a table of production of phosphate rock for the years 1934-1936. The section describing the mining and treatment of raw phosphate rock has been omitted from the new volume, and the chapter on the history and chemistry of soluble phosphates is largely a reprint of that in the earlier edition, with some new matter added.

Those sections of the book dealing with recent developments in the actual manufacture of calcium superphosphate have been almost entirely rewritten and brought up to date. Details are given of the improvements in established practices of the newer manufacturing processes, such as the Oberphos system, and of the methods employed to produce superphosphate in a granular form, easy to apply to the land.

The authors emphasise the importance at the present time of basic slag, on account of the Government's Land Fertility Scheme, although they imply that this scheme favours the use of basic slag at the expense of the higher grade phosphatic fertilisers. It must, however, be remembered that, in addition to the phosphate content, the lime and probably some minor constituents of basic slag are also important for land improvement. The preparation of compound fertilisers and the

advantages of large-scale manufacture are dealt with adequately, and numerous formulæ for typical manures suitable for specific crops and soils are included.

Throughout the book the importance of costing systems is emphasised. It is pointed out that, in this country, the bulk of the raw materials employed in the industry—phosphate rock, and pyrites or sulphur for the manufacture of sulphuric acid—must be imported, and the authors consider that more use might well be made of home-produced spent oxide (from gas purification) as a raw material for making the acid. A survey of the many factors to be considered in the design and operation of a superphosphate works, together with a review of numerous suggested methods and modifications in manufacture, and an outline of the authors' ideas as to the trend of future developments concludes the volume.

One point of criticism may be made. The methods of analysis of basic slag quoted are those of the Fertiliser and Feeding Stuffs Act (Regulations) of 1908, whereas the Regulations of 1932 introduced very important alterations in the method for determination of total phosphoric acid.

The book is well printed and lavishly illustrated, largely with pictures of proprietary items of engineering plant. Taken as a whole, it provides an adequate survey of the details of recent developments and current practice in the technique of the manufacture of calcium superphosphate and should continue to be of much service to those connected in any way with the industry.

BIBLIOGRAPHY

Comprising the more important reports, articles, etc., contained in mineral publications received in the Library of the Imperial Institute during the three months, May-July 1939.

The publications issued by the Governments of the Colonies and Protectorates can be obtained from or through the Crown Agents for the Colonies, 4 Millbank, Westminster, S.W.1. Applications for Dominion and Indian Government publications may be made to the Offices of the High Commissioners or Agents-General in London.

OFFICIAL ANNUAL REPORTS

Seventeenth Annual Report of the Safety in Mines Research Board, including a Report of Matters dealt with by the Health Advisory Committee, 1938. *Mines Dep.* Pp. 123, $9\frac{1}{2} \times 6$. (London: H.M. Stationery Office, 1939.) Price 2*s*.

Nyasaland Protectorate: Annual Report of the Geological Survey Department for the year 1938. Pp. 22, 13 × 8, and maps. (Zomba: Government Printer, 1939.) Price 2*s.* 6*d.*

Northern Rhodesia: Department of Lands, Mines and Surveys, Annual Report for the year ended December 31, 1938. Part IV—Mines. Pp. 15, 13½ × 8½. (Lusaka: Government Printer, 1939.) Price 1*s.*

Southern Rhodesia: Report of the Secretary, Department of Mines and Public Works on Mines, for the year 1938. Pp. 36, 13 × 8½. (Salisbury: Government Stationery Office, 1939.)

Uganda Protectorate: Annual Report on the Geological Survey Department for the year ended December 31, 1938. Pp. 40, 9¾ × 6, and maps. (Entebbe: Government Printer, 1939.) Price 2*s.*

Quebec: Mining Industry and Statistics of the Province for the year 1937. Pp. 138, 9¾ × 6½. (Quebec: King's Printer, 1938.)

Ontario: Forty-sixth Annual Report of the Department of Mines, 1937. Vol. 46, Parts IV to VII. Pp. 260, 9¾ × 6½, and maps. (Toronto: King's Printer, 1938.)

Ontario: Forty-seventh Annual Report of the Department of Mines, 1938. Vol. 47, Part I. Pp. 308, 10 × 6½. (Toronto: King's Printer, 1939.)

Manitoba: Tenth Annual Report on Mines and Minerals for the year ending April 30, 1938. *Mines Branch.* Pp. 151, 11 × 8½. (Winnipeg: Department of Mines and Natural Resources, 1939.)

British Columbia: Annual Report of the Minister of Mines of the Province for the year ended December 31, 1938. Part D, South Central District. By M. S. Hedley. Pp. 44, 10½ × 7½. (Victoria, B.C.: King's Printer, 1939.)

British Columbia: Annual Report of the Minister of Mines of the Province for the year ended December 31, 1938. Part C, North-Eastern District. By D. Lay. Pp. 57, 10½ × 7½. (Victoria, B.C.: King's Printer, 1939.)

British Columbia: Annual Report of the Minister of Mines for the year ended December 31, 1938. Part E, South-Eastern District. By R. J. Maconachie. Pp. 49, 10½ × 7½. (Victoria, B.C.: King's Printer, 1939.)

British Columbia: Annual Report of the Minister of Mines of the Province for the year ended December 31, 1938. Part F, South-Western District. By H. Sargent. Pp. 75, 10½ × 7½. (Victoria, B.C.: King's Printer, 1939.)

Mysore: Report of the Chief Inspector of Mines and Explosives for the year 1937-1938, with Statistics for the Calendar year 1937. Pp. 52, 13 × 8½. (Bangalore: Government Press, 1939.) Price Rs. 2.

The Federated Malay States Chamber of Mines (Incorporated) Year Book for 1938. Pp. 302, 8½ × 5½. (Ipoh: F.M.S. Chamber of Mines, 1939.)

Federated Malay States: Report of the Geological Survey Department for the year 1938. By F. T. Ingham. Pp. 52, 9¾ × 6. (Kuala Lumpur: Government Press, 1939.) Price 25 cents. or 7*d.*

Queensland: Advance Copy of the Annual Report of the Under-Secretary for Mines on the Queensland Mining Industry for 1938. *Queensland Govt. Min. J.*, 1939, **40**, 73-86.

South Australia: Mining Review, No. 68, for the half-year ended June 30, 1938. Pp. 101, 9½ × 6. (Adelaide: Government Printer, 1938.)

Northern Australia: Report of the Committee appointed to direct and control the Aerial, Geological and Geophysical Survey of Northern Australia, for the period ended December 31, 1937. Pp. 98, 13 × 8½,

and maps. (Canberra: Commonwealth Government Printer, 1938.) Price 5*s*.

Northern Australia: Report of the Committee appointed to Direct and Control the Aerial, Geological and Geophysical Survey for the Period ended June 30, 1938. Pp. 19, 13 × 8½, and maps. (Canberra: Government Printer, 1939.) Price 1*s*.

Bureau d'Études Géologiques et Minières Coloniales. Annuaire 1938-1939. Pp. 631, 8¾ × 5½. (Paris: Bureau d'Études Géologiques et Minières Coloniales, 1939.) Price fr. 40.

Luxembourg: Les Industries Extractives du Grand-Duché, Année 1938. Statistique et vue d'ensemble. Pp. 42, 8¾ × 5¾. (Luxembourg: Administration des Mines, 1939.)

Gouvernement Général de l'Afrique Occidentale Française: Rapport sur l'Industrie Minérale, 1937. Pp. 20, 10½ × 8¼. (Dakar: Service des Mines, 1938.)

Brazil: Relatorio Annual do Director, anno de 1935. *Serv. Geol. Mineral.* Pp. 187, 9 × 6¼. (Rio de Janeiro: Directoria de Estatistica da Producção, 1936.)

Brazil: Relatorio Annual do Director, anno de 1936. *Serv. Geol. Mineral.* Pp. 148, 9 × 6¼. (Rio de Janeiro: Directoria de Estatistica da Producção, 1937.)

Peru: Estadística Minera de la Nacion, año 1937. By J. M. Gerez. *Publ. No.* 118, *Direcc. Minas Geol.* Pp. 80, 10 × 7¼. (Buenos Aires: Ministerio de Agricultura de la Nacion, 1939.) Price $0.50. Datos económico-industriales sobre: precios, usos, zonas de producción, importación, exportación, etc., de los minerales.

MINING LAW

Kenya: The Oil Production Ordinance, 1924—Regulations, 1939. Govt. Notice No. 335. *Kenya Offic. Gaz.*, May 9, 1939, **41**, No. 21, Suppt. No. 19, pp. 165-305.

Tanganyika Territory: The Mining (Amendment) Regulations, 1939. Govt. Notice No. 59. *Tang. Terr. Gaz.*, May 5, 1939, **20**, No. 19, Suppt., p. 71.

Tanganyika Territory: The Mining (Controlled Areas) (Amendment) Regulations, 1939. Govt. Notice No. 60. *Tang. Terr. Gaz.*, May 5, 1939, **20**, No. 19, Suppt., pp. 71-72.

South-West Africa: Diamond Industry Protection Proclamation, 1939. Proc. No. 17 of 1939. *Offic. Gaz. Extraord. S.W. Africa*, April 17, 1939, No. 787, pp. 1812-1822.

British Honduras: A Bill entitled An Ordinance to amend the Petroleum (Production) Ordinance, 1937 (No. 17 of 1937) and to repeal the Oil Mines Ordinance—Chapter 86 of the Consolidated Laws, 1924. *Govt. Gaz. Brit. Honduras*, February 18, 1939, No. 18, 2 pp.

India: An Act to make further Provision for safety in Coal Mines. Act No. XIX of 1939. *Gaz. of India*, April 29, 1939, Part IV, pp. 169-173.

Hong Kong: An Ordinance to Consolidate and Amend the Law relating to the Taxation of Hydrocarbon Oils. No. 11 of 1939. *Hong Kong Govt. Gaz.*, March 31, 1939, pp. 307-341.

Roumania's New Mining Law. *Petrol. Times*, 1939, **41**, 749-750, 782-783. A review of the proposals which have been made by the Petroleum Association.

U.S.A.: Requirements for Ventilation—Alabama Mining Law. By F. E. Cash. *Inform. Circ. No.* 7068, *U.S. Bur. Mines.* Pp. 5, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

COMMERCIAL INTELLIGENCE

The Metal Industry Handbook and Directory, 1939, No. 28. Pp. 452, 9 × 6. (London: Louis Cassier Co., 1939.)

Industrial Minerals: A Quarterly Report showing Production, Local Sales, Exports and Names of Producers of Industrial Minerals for the Union of South Africa and the Territory of South-West Africa. *Quart. Inform. Circ. No.* 17, *January-March*, 1939, *Dep. Mines, Union S. Afr.* Pp. 42, 11 × 8½. (Pretoria: Government Printer, 1939.)

Report on the Miscellaneous Non-Metallic Minerals in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 25, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1939.) Price 15 cents.

List of Mines other than Coal Mines worked under the Indian Mines Act, 1923. Corrected up to September 30, 1937. Pp. 223, 13 × 8½. (Calcutta: Government of India Press, 1939.)

Year Book of the American Bureau of Metal Statistics. Nineteenth Annual Issue, 1938. Pp. 120, 10¾ × 8½. (New York: American Bureau of Metal Statistics, 1939.)

GEOLOGY AND MINERAL RESOURCES

A Source Book in Geology. By K. Mather and S. L. Mason. Pp. xxii + 702, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 30*s*.

Tanganyika Territory: Preliminary Report on the Geology and Gold Occurrences of the Kahama Region. By D. R. Grantham and B. N. Temperley. *Sh. Pap. No.* 21, *Geol. Div., Dep. Lds. Mines.* Pp. 14, 10 × 7, and maps. (Dar es Salaam: Government Printer, 1939.) Price 2*s*.

Tanganyika Territory: Outline of the Geology of the Uruwira Mineral Field. By G. M. Stockley. *Sh. Pap. No.* 22, *Geol. Div., Dep. Lds. Mines.* Pp. 22, 10 × 7, and map. (Dar es Salaam: Government Printer, 1939.) Price Shs. 2/50. An account of the general and economic geology of the area.

Industrial Minerals of Canada in 1938. By L. H. Cole. *Canad. Min. Metall. Bull.*, 1939, No. 326, 273-290.

The Canadian Mineral Industry—The Provinces: (*f*) Quebec; (*g*) The Maritimes; (*h*) Yukon and the North-west Territories. By E. J. Pryor. *Min. Mag., Lond.*, 1939, **60**, 278-284, 337-344.

Geology of the North Spirit Lake Area. By J. D. Bateman. *Ann. Rep. Ontario Dep. Mines*, 1938, **47**, Part VII, 43-78. An account of the general and economic geology of the area.

Recent Developments in the Favourable Lake Area. By J. D. Bateman. *Ann. Rep. Ontario Dep. Mines*, 1938, **47**, Part VII, 79-92. An account of recent mining and prospecting activities.

Geology of the Keefer-Eldorado Area. By W. D. Harding and L. G. Berry. *Ann. Rep. Ontario Dep. Mines*, 1938, **47**, Part IV, 1-26. An account of the general and economic geology of the area.

Geology of the Sandy Lake Area. By J. Satterly. *Ann. Rep. Ontario Dep. Mines*, 1938, **47**, Part VII, 1-43. An account of the general and economic geology of the area.

The Crow River Area. By J. E. Thomson. *Ann. Rep. Ontario Dep. Mines*, 1938, **47**, Part III, 1-65. An account of the general and economic geology of the area.

The Uchi Lake Area. By J. E. Thomson. *Ann. Rep. Ontario Dep. Mines*, 1938, **47**, Part III, 65-82. An account of the general and economic geology of the area.

Geology and Ore Deposits of the Zeballos Area, British Columbia. By J. S. Stevenson. *Canad. Min. Metall. Bull.*, 1939, No. 324, 225-237.

The Geology of Gujarat and Southern Rajputana. By B. G. Gupta and P. N. Mukerjee. *Rec. Geol. Surv. India*, 1938, **73**, Part 2, 163-208. An account of the general and economic resources of the area.

Germany's Drive for Mineral Self-sufficiency. By C. W. Wright. *Min. and Metall.*, 1939, **20**, 241-247.

Die Erzlagerstätten des Sudetengaues. By F. Wernicke. *Metall u. Erz*, 1939, **36**, 208-216.

Die Bergbauwirtschaft Griechenlands und Albaniens. *Metall u. Erz*, 1939, **36**, 270-273.

Die Mineralvorkommen in der Gemeinde Detschani in Nordwest Mazedonien. By G. Petunnikov. *Montan. Rdsch.*, 1939, **31**, 341-344. A description of marble, chromium and asbestos deposits.

L'Intensificazione delle Ricerche e della Produzione ai fini Autarchici di alcuni Metalli complementari della Siderurgia. By A. Linoli. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 258-262.

La Provincia di Novara e le sue Ricchezze Minerarie. By L. Peretti. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 246-254.

Cenni Sugli Sviluppi della Produzione Mineraria Italiana nel quadriennio 1935-1938. By F. Squarzina. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 91-117.

Italy's Drive for Mineral Self-sufficiency. By C. W. Wright. *Min. and Metall.*, 1939, **20**, 289-296.

La Spagna Mineraria. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 148-152.

Seltene Metalle in der Sowjetunion. *Metall u. Erz*, 1939, **36**, 250-252.

Strategic Raw Materials. By F. J. van Antwerpen. *Industr. Engng. Chem.* (*Industr. Ed.*), 1939, **31**, 520-530. An examination as to need and quantity of raw materials imported into the United States.

Colorado: Guide to the Geology of the Golden Area. By F. M. van Tuyl, J. H. Johnson, W. A. Waldschmidt, J. Boyd and B. H. Parker. *Colo. Sch. Mines Quart.*, 1938, **33**, No. 3, 1-32, and map. An account of the general and economic geology of the area. Price 50 cents.

Telluride-Tungsten Mineralisation of the Magnolia Mining District, Colorado. By A. S. Wilkerson. *Econ. Geol.*, 1939, **34**, 437-450.

Cambrian Formations of the Eureka and Pioche Districts, Nevada. By H. E. Wheeler and D. M. Lemmon. *Bull. Univ. Nevada*, 1939, **33**, No. 3, 1-60 (Geol. and Min. Ser. No. 31). An account of the Cambrian formations in relation to their economic significance.

Mining Development in the Argentine. *Min. J.*, 1939, **205**, 601.

Memoria de la Comision Geologica del Valle del Mezquital, Hgo. Pp. 239, 9 × 6½, and maps. (Mexico: Universidad Nacional de Mexico, Instituto de Geologia, 1938.)

Peru: Algunos Yacimientos Metaliferos de la Provincia de San Juan. By V. Angelelli. *Bol. No.* 46, *Direcc. Minas Geol.* Pp. 38, 10½ × 7½. (Buenos Aires: Ministerio de Agricultura de la Nacion, 1938.) Price $1.00.

Fifteen Years of Mining in the Turkish Republic. *Engng. Min. J.*, 1939, **140**, No. 5, 34-35. An account of the development of mineral resources under Government auspices.

PROSPECTING AND MINING METHODS

(*See also under Metals and Non-Metals.*)

A New Geophysical Instrument. By J. McG. Bruckshaw. *Min. Mag., Lond.*, 1939, **60**, 265-271. A description of a field test with an instrument designed to use inductive magnetic methods.

Shaft Sinking by Benching. By J. D. Cumming. *Canad. Min. J.*, 1939, **60**, 274-275.

Values in Alluvial Cores. By H. L. Holloway. *Min. Mag., Lond.*, 1939, **61**, 9-13. A discussion of various allowances that should be made in the course of evaluating drilling results.

Cost of Developing a Small Mine. By M. D. Isbister. *Canad. Min. J.*, 1939, **60**, 275-279.

Notes on the Modern Development of the Drag Round. By R. H. MacWilliam and R. C. J. Goode. *J. Chem. Soc. S. Afr.*, 1939, **39**, 324-331.

The Time Factor in Deep Mine Ventilation—Some Deductions from Borehole Temperatures and Allied Observations. By J. P. Rees. *J. Chem. Soc. S. Afr.*, 1939, **39**, 311-322.

Quelques remarques sur les Mines métalliques Tropicales et en particulier sur les Mines d'Or. By R. Sauze. *Publ. No.* 13, *Bur. d'Études Géol. Min. Colon.* Pp. 16, 10 × 6½. (Paris: Bureau d'Études Géologiques et Minières Coloniales, 1939.) Price frs. 10.

Use of Divining Rod in Location of Mineral Deposits. By H. A. Vaudeau. *Chem. Engng. Min. Rev.*, 1939, **31**, 299-304.

Essentials in Developing and Financing a Prospect into a Mine. By C. W. Wright. *Pre-Cambrian*, 1939, **12**, No. 7, 3-11.

General Mining Conditions in West Africa. By B. J. Hastings. *J. Chem. Soc. S. Afr.*, 1939, **39**, 211-215.

Methods of Stowing for Indian Mines. By J. Thomas. *Trans. Min. Geol. Metall. Inst. India*, 1939, **35**, Part 1, 51-83. A review of underground packing problems in Indian collieries.

Geophysical Surveying in Northern Australia. *Chem. Engng. Min. Rev.*, 1939, **31**, 359-364.

Spud Dredges for Heavy Ground in New Zealand. *Chem. Engng. Min. Rev.*, 1939, **31**, 323-327.

Magnetische Untersuchungen im Vulkanfelde der Bergfreiheitgrube von Schmiedeberg im Riesengebirge. By F. Kutscher. *Z. prakt. Geol.*, 1939, **47**, 67-71.

CONCENTRATION AND METALLURGY

(*See also under Metals and Non-Metals.*)

Investigations in Ore Dressing and Metallurgy, July to December 1937. *Bur. Mines Publ. No.* 788, *Dep. Mines Res. Canada.* Pp. 137, 9¾ × 6½. (Ottawa: King's Printer, 1938.)

Cyanidation of Clayey Gold Ores. *Chem. Engng. Min. Rev.*, 1939, **31**, 243-245.

A Cyanide Process based on the Simultaneous Dissolution and Adsorption of Gold. By T. G. Chapman. *Canad. Min. J.*, 1939, **60**, 345-348.

Non-Sulphide Flotation. By F. B. Michell. *Min. Mag., Lond.*, 1939, **60**, 272-277. A review of certain modern developments in flotation practice.

Une Méthode nouvelle en Métallurgie aurifère: L'Amalgamation sous pression par utilisation de la Tension superficielle. By G. Passelecq. *Publ. No.* 13, *Bur. d'Études Géol. Min. Colon.* Pp. 18, 10 × 6½. (Paris: Bureau d'Études Géologiques et Minières Coloniales, 1939.) Price frs. 10.

"Sink and Float" at Halkyn Mill. By A. Pearson and others. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 417, 83 pp.

Gleaners of the Witwatersrand: the Recovery of Gold from old Sands and Slimes Dumps. *S. Afr. Min. Engng. J.*, 1939, **50**, Part 1, 517-521.

Some Trends in the Treatment of Gold Ores in Canada. By H. Hanson. *Engng. Min. J.*, 1939, **140**, No. 6, 39-41.

New Gold-Copper Smelter at Mount Morgan (Queensland) in Operation. By M. E. Playford. *Chem. Engng. Min. Rev.*, 1939, **31**, 246-247.

METALS

Aluminium and Bauxite

Aluminium Industry in Canada. By T. L. Bullock. *Light Metals*, 1939, **2**, 249-254.

Plans for New Aluminium Industry in Australia. *Chem. Engng. Min. Rev.*, 1939, **31**, 307.

The Aluminium Industry of Italy. By R. J. Anderson. *Min. Mag., Lond.*, 1939, **61**, 13-27. A review of its rapid development.

Les Bauxites de Tougué. By R. Goloubinow. *Bull. Services Mines* (*A.O.F.*), 1938, No. 1, 77-80. A description of a bauxite deposit on the borders of Central Guinea and the Western Sudan.

Chromium

Britain's Chrome Requirements. *S. Afr. Min. Engng. J.*, 1939, **50**, Part I, 545.

Die Chromerzlagerstätten der östlichen Rhodopen in Bulgarien. By W. E. Petrascheck. *Z. prakt. Geol.*, 1939, **47**, 61-67.

Le Gisement de Chromite de Bontomo (Haut-Dahomey). By A. Chermette. *Bull. Service Mines* (*A.O.F.*), 1938, No. 1, 69-73.

Turkey and its Chrome Ore. By E. Perkins. *Engng. Min. J.*, 1939, **140**, No. 6, 29-34.

Columbium

The Production of Stable Stainless Steel. *Metallurgia, Manchr.*, 1939, **19**, 187-189. The use of columbium as a carbide-forming element in stainless steel.

Copper

The Copper Resources of New Zealand. By J. Henderson. *Dep. Sci. Industr. Res.* Pp. 4, 10 × 6½. (Wellington, N.Z.: Government Printer, 1939.) Extracted from *N.Z. J. Sci. Tech.*, 1939, **20**, 177B-181B.

Gold

The Komati River—Swaziland Goldfield. *S. Afr. Min. Engng. J.*, 1939, **50**, Part I, 294-296.

Gold Deposits of the Central Murchison Range, Transvaal. By E. Mendelssohn. *Trans. Geol. Soc. S. Afr.*, 1938, **41**, 249-272.

The Upper Witwatersrand System at Randfontein Estates. By E. R. Roberts and D. Kransdorff. *Trans. Geol. Soc. S. Afr.*, 1938, **41**, 225-247.

The Gold Occurrences south-west of Pietersburg. By J. Willemse. *Geol. Ser. Bull. No. 12, Dep. Mines, Union S. Afr.* Pp. 38, 9½ × 6. (Pretoria: Government Printer, 1938.) Price 6*d*.

British Guiana: Report on the Aranka Goldfield, Cuyuni River. By D. A. B. Davies. *Bull. No. 10, Geol. Surv. Brit. Guiana.* Pp. 25,

$9\frac{3}{4} \times 7\frac{1}{2}$, and map. (Georgetown, Demerara: Government Printers, 1939.) Price 24 cents.

Manganese and Gold Deposits in the Lower and Middle Barama River, North West District, British Guiana. By D. A. B. Davies. *Offic. Gaz. Brit. Guiana*, March 25, 1939, **87,** 1103-1106.

Structural Relations of some Gold Deposits between Lake Nipigon and Long Lake, Ontario. By E. L. Bruce. *Econ. Geol.*, 1939, **34,** 357-368.

Milling at Central Patricia Gold Mines Limited, Ontario. By N. Gritzuk. *Canad. Min. J.*, 1939, **60,** 255-260.

Tailing Disposal at the Sullivan Concentrator of the Consolidated Mining and Smelting Company of Canada, Ltd., British Columbia. By A. L. Irwin. *Canad. Min. Metall. Bull.*, 1939, No. 325, 268-273.

Relation of Gold Deposits to Structure, Yellowknife and Gordon Lake Areas, North-west Territories. By J. F. Henderson and A. W. Jolliffe. *Canad. Min. Metall. Bull.*, 1939, No. 326, 314-335.

Gold Discovery near Fern Springs—Charters Towers Goldfield. By C. C. Morton. *Queensland Govt. Min. J.*, 1939, **40,** 90-91.

Gold und Goldbergbau in Schlesien. By H. Mohr. *Montan. Rdsch.*, 1939, **31,** 263-268.

Prospettive sulla Produzione Aurifera Italiana. By A. Stella. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13,** 198-200.

Brazil: A Politica do Ouro. By E. P. de Oliveira. *Bol. No.* 73, *Serv. Geol. Mineral.* Pp. 46, $10\frac{1}{2} \times 7\frac{1}{4}$. (Rio de Janeiro: Ministerio da Agricultura, 1937.)

Gold in Peru. By H. R. Beckwith. *Engng. Min. J.*, 1939, **140,** 49-53. A brief description of gold occurrences and mining developments.

Iron and Steel

The Krupp Renn Process. *Min. J.*, 1939, **206**, 648-649.

Funkgeologische Untersuchungen in Spateisensteinlagern. By V. Fritsch. *Glückauf*, 1939, **75,** 385-390.

The Iron Ore Mine at Thabazimbi, Transvaal. *S. Afr. Min. Engng. J.*, 1939, **50,** Part 1, 217-218.

Werdegang der direkten Eisen- und Stahlerzeugung in der Zeit vom Jahre 1933 bis zur Gegenwart. By H. Leobner. *Montan. Rdsch.*, 1939, **31,** 335-340.

Le Fer dans le Cercle de Kandy (Haut-Dahomey). By A. Chermette. *Bull. Service Mines* (*A.O.F.*), 1938, No. 2, 13-16.

Report on Available Raw Materials for a Pacific Coast Iron Industry. Vol. II: Appendix B, Market; Appendix C, Scrap; Appendix D, Economic Factors. By E. T. Hodge. *War Dep., Corps of Engineers, U.S. Army.* Pp. 151, $10\frac{1}{2} \times 8$. (Portland, Oregon: Office of the Division Engineer, North Pacific Division, 1935.)

Report on Available Raw Materials for a Pacific Coast Iron Industry. Vol. V: Part I, Information on Additional Iron Ores of the North-west; Part II, The Need, Market, and possible Methods of Production of Iron in the Pacific North-west. By E. T. Hodge. *War Dep., Corps of Engineers, U.S. Army.* Pp. 106, $10\frac{1}{2} \times 8$. (Portland, Oregon: Office of the Division Engineer, North Pacific Division, 1938.)

The Brown Iron Ores of Eastern Texas. By E. B. Eckel. *Geol. Surv. Bull. No.* 902, *U.S. Dep. Int.* Pp. 157, 9×6, and maps. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1938.) Price $1.

Geology of the Iron Ore Deposit of Ninghsiang, Hunan. By Y. L. Wang, T. Y. Liu and Y. C. Ch'eng. *Bull. Geol. Surv. China*, 1938, No. 32, 1-11.

Lead and Zinc

European and World Zinc Situation in 1938. By O. W. Roskill. *Min. J.*, 1939, **205**, 475-476. Abstract of a paper read before the American Zinc Institute.

Milling Methods and Costs at the Mount Isa Mines, Ltd., Mount Isa, Queensland, Australia. By J. Kruttschnitt, L. K. Jacobsen and K. B. Gross. *Inform. Circ. No.* 7073, *U.S. Bur. Mines.* Pp. 33, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Die Aufbereitung von komplexen Blei-Zink-Schwefelerzen der Neuen Viktoria-Neuhof-Grube in Beuthen (Oberschlesien). By H. Glatzel. *Metall u. Erz*, 1939, **36**, 379-383.

Über die Nutzbarmachung des Zink-, Blei- und Eiseninhalts von Bleischlacken. By F. Brenthel. *Metall u. Erz*, 1939, **13**, 355-361.

Producing Electrolytic Zinc in the Soviet Union. By J. H. Gillis. *Engng. Min. J.*, 1939, **140**, No. 5, 29-33.

An Open-Pit Zinc-Lead Mine in the Tri-State District. By W. F. Netzeband and H. O. Gray. *Engng. Min. J.*, 1939, **140**, No. 6, 52-55.

Manganese

Manganese and Gold Deposits in the Lower and Middle Barama River, North West District, British Guiana. By D. A. B. Davies. *Offic. Gaz. Brit. Guiana*, March 25, 1939, **87**, 1103-1106.

Notes on Manganese Deposits (Mary Valley District, Queensland). By S. R. L. Shepherd. *Queensland Govt. Min. J.*, 1939, **40**, 117-118.

Note sur le Minerai de Manganèse de l'Imini (Maroc). By R. Zvéreff. *Ann. Min., Paris*, 1939, **15**, 115-122.

Preliminary Report on Manganese Ore beneficiation at Grawfus Mining Company, Dirique Ilocos Norte. By W. F. Boericke and N. N. Lim. *Inform. Circ. No.* 2, *Bur. Mines, Manila.* Pp. 12, 9 × 6. (Manila: Department of Agriculture and Commerce, 1939.)

Mercury

Il Mercurio e la sua Utilizzazione. By V. Novarese. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 255-257.

Radium and Uranium

Uranium: Uses of Compounds and Metal. *Canad. Chem. Proc. Industr.*, 1939, **23**, 177-178.

Tantalum

Tantalite in the Northern Territory, Australia. By A. E. Williams. *Chem. Engng. Min. Rev.*, 1939, **31**, 285-289.

Tin

Notes on the Volumetric Determination of Tin. By J. J. Frankel. *J. Chem. Soc. S. Afr.*, 1939, **39**, 290-295.

Tinplate and By-Products. *Industr. Chem. Chem. Mfr.*, 1939, **15**, 198-203. A description of the new works of Richard Thomas & Co., Ltd., at Ebbw Vale, South Wales.

Tin-Tungsten Mineralisation at Mawchi, Karenni States, Burma. By J. A. Dunn. *Rec. Geol. Surv. India*, 1938, **73**, Part 2, 209-234.

Tin-Tungsten Mineralisation at Hermyingyi, Tavoy District, Burma. By J. A. Dunn. *Rec. Geol. Surv. India*, 1938, **73**, Part 2, 238-246.

Tin Deposits of the Black Hills, South Dakota. By E. D. Gardner. *Inform. Circ. No.* 7069, *U.S. Bur. Mines.* Pp. 78, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Titanium

Zircon, Ilmenite and Monazite Mining in India. By G. H. Chambers. *Foote-Prints*, 1939, **12**, No. 1, 1-11.

Zircon and Rutile from Beach Black Sand Deposits. By W. R. Poole. *Chem. Engng. Min. Rev.*, 1939, **31**, 250-257.

Le Titane au Dahomey. By A. Chermette. *Bull. Service Mines* (*A.O.F.*), 1938, No. 1, 51-66.

Tungsten

Tungsten. By L. Sanderson. *Canad. Min. J.*, 1939, **60**, 351-353. A general account of the sources and uses of tungsten.

Tin-Tungsten Mineralisation at Mawchi, Karenni States, Burma. By J. A. Dunn. *Rec. Geol. Surv. India*, 1938, **73**, Part 2, 209-234.

Tin-Tungsten Mineralisation at Hermyingyi, Tavoy District, Burma. By J. A. Dunn. *Rec. Geol. Surv. India*, 1938, **73**, Part 2, 238-246.

NON-METALS

Asbestos

A Great Asbestos Enterprise—the Havelock Mine, Swaziland. *S. Afr. Min. Engng. J.*, 1939, **50**, Part I, 289-294.

Manufacturing Operations of Canadian Johns-Manville Company, Ltd., at Asbestos, P.Q. *Canad. Min. J.*, 1939, **60**, 205-213.

Mining and Milling Operations of the Canadian Johns-Manville Company, Ltd., at Asbestos, P.Q. By R. C. Rowe. *Canad. Min. J.*, 1939, **60**, 185-204.

L'Amianto: la sua Estrazione ed i suoi Impieghi in Italia. By F. Massone. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 139-147.

Building Materials

South Africa's Slate Industry. *S. Afr. Min. Engng. J.*, 1939, **50**, Part 1, 362-363.

The Sand and Gravel Industry in Canada, 1937. *Min. Metall. Chem. Br., Canada.* Pp. 12, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1939.) Price 15 cents.

The Stone Industry in Canada, 1937. Including: 1, The Stone Quarrying Industry; 2, The Monumental and Ornamental Stone Industry. *Min. Metall. Chem. Br., Canada.* Pp. 38, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1939.) Price 25 cents.

Die nutzbaren steine und Erden des Saarlandes und ihre Verwertung. By A. Graupner. *Z. prakt. Geol.*, 1939, **47**, 85-97, 106-118.

Slates of East Tennessee. By H. C. Amick. *Econ. Geol.*, 1939, **41**, 451-458.

China Clay

Das neue Kaolin vorkommen von Szegi bei Tokaj. By F. Kirnbauer. *Z. prakt. Geol.*, 1939, **47**, 71-75.

Coal, etc.

Coke and By-Products Manufacture. By E. C. Dixon. Pp. vii + 176, 7¾ × 5½. (London: Charles Griffin & Co., Ltd., 1939.) Price 6*s*.

The Nature and Origin of Coal and Coal Seams. By A. Raistrick and C. E. Marshall. Pp. 282, 8½ × 5½. (London: The English Universities Press, Ltd., 1939.) Price 12*s*. 6*d*.

Methods of Analysing Coal and Coke. By F. M. Stanton, A. C. Fieldner and W. A. Selvig. *Tech. Pap. No.* 8, 1938 *Edition, U.S. Bur. Mines.* Pp. 59, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 15 cents.

Coal Mining in Europe: A Study of Practices in different Coal Formations and under various Economic and Regulatory Conditions compared with those in the United States. By G. S. Rice and I. Hartmann. *Bull. No.* 414, *Bur. Mines, U.S. Dep. Int.* Pp. 369, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 50 cents.

Reports of H.M. Inspectors of Mines under the Coal Mines Act, 1911, for the year 1938. VII. Swansea Division. By P. S. Lea. *Mines Dep.* Pp. 49, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 1*s*.

Reports of H.M. Inspectors of Mines under the Coal Mines Act, 1911, for the year 1938. VIII. Midland and Southern Division. By E. Rowley. *Mines Dep.* Pp. 72, 9½ × 6. (London: H.M. Stationery Office, 1938.) Price 1*s*.

The Correlation of Coal Seams by Microspore Content. Part II, The Trencherbone Seam, Lancashire, and the Busty Seams, Durham. By A. Raistrick. *Trans. Instn. Min. Engrs.*, 1939, **97**, 425-431.

The Yorkshire, Nottinghamshire and Derbyshire Coalfield, West Yorkshire Area: the Barnsley-Warren House Seam. *Phys. Chem. Surv. Nat. Coal Res. Pap. No.* 46, *Fuel Res. Bd., Dep. Sci. Industr. Res.* Pp. 74, 9¾ × 6, and map. (London: H.M. Stationery Office, 1939.) Price 2*s*.

Studies on Indian Coals. Part III, Proximate Composition, Decomposition Temperature, Swelling Effect, Low Temperature Carbonisation, Porosity of Semi-Coke, Electrical Conductivity of Semi-Coke, Analysis of Low and High Temperature Coal Tars and the Determination of Flash Points and Viscosities of Different Fractions of Tar Oils. By K. L. Roy, D. Lahiri and B. C. Guha. *J. Indian Chem. Soc.* (*Industr. News Ed.*), 1939, **2**, No. 1, 28-44.

Étude sur le Bassin permo-houiller de Saône-et-Loire, et les Plissements hercyniens du Plateau Central. By E. Roidot. *Rev. Industr. Min.*, 1939, No. 440, 203-220.

Ricerca ed Estrazione di Carboni e loro Sostituzione a Combustibili Fossili d'Importazione. By U. Cattanio. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 263-269.

Coal in Sardinia: the Sulcis Coalfield and the Carbonia Mining Centre. By D. Sandulli. *Iron Coal Tr. Rev.*, 1939, **138**, 875. Abstract of an article in *Il Calore.*

Carbonising Properties and Petrographic Composition of Pittsburgh Bed Coal from Bureau of Mines Experimental Mine, Bruceton, Allegheny County, Pa. By A. C. Fieldner, J. D. Davis, R. E. Brewer, W. A.

Selvig, D. A. Reynolds and G. C. Sprunk. *Tech. Pap. No.* 594, *U.S. Bur. Mines.* Pp. 43, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Fluorspar

Newfoundland ships Fluorspar. By C. K. Howse and R. P. Fischer. *Engng. Min. J.*, 1939, **140**, No. 7, 42-45.

The Fluorspar Industry of the United States with special reference to the Illinois-Kentucky District. By P. Hatmaker and H. W. Davis. *Bull. No.* 59, *Illinois State Geol. Surv.* Pp. 128, 9¾ × 6¾. (Urbana: Department of Registration and Education, 1938.)

Gypsum

Um Estudo sobre a Gypsita. By G. de F. Alvim. *No.* 12, *Notas Prelim. Estud., Serv. Geol. Mineral.* Pp. 16, 9¼ × 6. (Rio de Janeiro: Ministerio da Agricultura, 1937.)

Lime and Limestone

Limestone in the Iron and Steel Industry. By N. B. Clarke. *Canad. Min. Metall. Bull.*, 1939, No. 324, 137-140.

Mica

Handbook of Mica. By R. R. Chowdhury. Pp. xvi + 344, 8½ × 5½. (Calcutta: Thacker, Spink & Co. (1933), Ltd.; London: W. Thacker & Co., 1939.) Price 22*s.* 6*d.*

Australian Mica—Properties and Nature of Stains. By E. E. Rooste. *Chem. Engng. Min. Rev.*, 1939, **31**, 369-374.

Nitrates

L'Industria del Nitrato di Soda nel Cile. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 168-171.

Petroleum, etc.

Les Gisements de Pétrole—Géologie, Statistique, Économie. By G. Macovei. Pp. 502, 10 × 6¾. (Paris: Masson et Cie, 120 Boulevard Saint Germain, 1938.) Price 120 frs. The character and origin of petroleum, with a detailed and geological description of world occurrences.

Europe—Scene of Active Oil Search. *World Petrol.*, 1939, **10**, No. 6, 70-74. Review of recent developments in Great Britain, France, Germany, Poland, Hungary and other countries.

Australian Oil Search: Survey of Progress in 1938. *Petrol. Times*, 1939, **42**, 79, 85.

Search for Oil in New Guinea and Papua. *Chem. Engng. Min. Rev.*, 1939, **31**, 378-381.

Sviluppo e Risultati dell'attività petrolifera Italiana in Albania. By O. Jacobini. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 206-207.

Oil Search in Greece. *Petrol. Times*, 1939, **41**, 622-623.

Metodo di Ricerca del Gas naturale in Terreni Indiziati da Manifestazioni di Superficie. By S. Leone. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 118-125.

I Petroli della Valle Latina: Ipotesi genetiche e Possibilità di

Sfruttamento. By G. Pulle. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 210-212.

Alcuni Criteri Basilari della Distribuzione Regionale dei Giacimenti Petroliferi in Applicazione alle ricerche. By S. Zuber. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 201-205.

Extensive Exploration awaits new Oil Law in Roumania. *World Petrol.*, 1939, **10**, No. 6, 64-65.

" The Second Baku "—Oil Search and Production between the Volga and the Urals. By A. Borman. *Min. J.*, 1939, **205**, 431.

Oil Resources of the U.S.S.R. By I. M. Gubkin. *Min. J.*, 1939, **205**, 582-583.

Near East Discoveries have led to Vast Increase in Activities. *World Petrol.*, 1939, **10**, No. 6, 44-51. Review of developments in petroleum production in the countries round the eastern shores of the Mediterranean, and in Asia between the Caspian Sea and the Indian Ocean.

Ras Gharib Discovery brings rush of Prospecting Activity to Egypt. *World Petrol.*, 1939, **10**, No. 6, 52-53.

Les Indices Pétrolifères de la Basse Côte d'Ivoire et de la Gold Coast. By J. Archambault. *Bull. Service Mines (A.O.F.)*, 1938, No. 2, 21-27.

Les Gisements de Bitume d'Eboïnda (Côte d'Ivoire). By J. Archambault. *Bull. Service Mines (A.O.F.)*, 1938, No. 2, 33-38.

Le Bitume de la Région d'Assinie (Côte d'Ivoire). By P. Rose. *Bull. Service Mines (A.O.F.)*, 1938, No. 2, 43-45.

Geology and Economic Significance of California's 1935-1938 Oil Discoveries. By W. W. Porter. *World Petrol.*, 1939, **10**, No. 2, 43-63.

Effect of Acid Treatment upon the Ultimate Recovery of Oil from some Limestone Fields of Kansas. By R. E. Heithecker. *Rep. Invest. No.* 3445, *U.S. Bur. Mines*. Pp. 47, $10\frac{1}{2} \times 8$. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Analyses of Crude Oils from Some Fields of Oklahoma. By O. C. Blade. *Rep. Invest. No.* 3442, *U.S. Bur. Mines*. Pp. 29, $10\frac{1}{2} \times 8$. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Geology of Middle and Upper Magdalena Valley, Colombia. By J. W. Butler. *World Petrol.*, 1939, **10**, No. 3, 95-100.

Development along the South American Oil Belt. *World Petrol.*, 1939, **10**, No. 6, 90-95.

Economic Aspects of Oilfield Exploitation in Colombia. By E. Ospina-Racines. *World Petrol.*, 1939, **10**, No. 3, 60-69, and map.

Petroleum Search broadened in the Far East. *World Petrol.*, 1939, **10**, No. 6, 54-61. Review of developments in the Netherlands East Indies.

Phosphates

Calcium Superphosphate and Compound Fertilisers: Their Chemistry and Manufacture. By P. Parrish and A. Ogilvie. Pp. xiv + 322, $9\frac{3}{4} \times 7\frac{1}{4}$. (London: Hutchinson's Scientific and Technical Publications, 1939.) Price 35*s*.

Refractories

First Report on Refractory Materials. *Spec. Rep. No.* 26, *Iron Steel Inst.* Pp. vi + 478, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: The Iron and Steel Institute, 1939.) Price 16*s*.

Salt

Marketing of Salt. By F. E. Harris. *Inform. Circ. No.* 7062, *U.S. Bur. Mines.* Pp. 56, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Sulphur

Recovery of Sulphur from Fuel Gases. By A. R. Powell. *Industr. Engng. Chem.* (*Industr. Ed.*), 1939, **31**, 789-796.

Il Commercio degli Zolfi Italiani. By C. Faina. *Industr. Min. Ital. Oltremare*, 1939-xvii, **13**, 213-218.

The Pyrite Deposit of Liuhuangshan, Yingteh, Kwangtung. By K. Chan. *Bull. Geol. Surv. China*, 1938, No. 32, 13-18.

Zircon

Zircon, Ilmenite and Monazite Mining in India. By G. H. Chambers. *Foote Prints*, 1939, **12**, No. 1, 1-11.

Zircon and Rutile from Beach Black Sand Deposits. By W. R. Poole. *Chem. Engng. Min. Rev.*, 1939, **31**, 250-257.

EXHIBITION GALLERIES, FILM LIBRARIES AND CINEMA

NOTES

Exhibition Galleries.—To complete the Travancore Court, a diorama of the port of Alleppey has been constructed by Mr. Herbert K. Rooke in the Imperial Institute studio and is now installed in a compartment specially reserved for it between two wall show-cases. The left-hand case contains ivory and silverware, a rosewood and ivory table chessboard and ivory chessmen. The right-hand case contains silverware made up of *chuckrums* which are old silver coins of Travancore, articles made from screwpine leaves, and rosewood tables inlaid with ivory. On the top, running across the whole length of the case, are five coloured transparencies showing the commercial, artistic and scenic aspects of the State. The diorama, occupying the central position, is set back a few inches from the glass front to accommodate examples of commodities exported from Alleppey, such as copra, coconut oil, dried ginger, pepper, tea, garnet sand, pyrrhotite and lemon grass oil. Thus this new arrangement successfully portrays the connection between the country and its products.

The label for this diorama reads as follows:

The Port of Alleppey.

"This diorama shows the harbour with the pier which juts out 985 feet into the sea and is equipped with cranes for handling cargo. Three boats are riding at anchor in the harbour, and in the distance a P. & O. liner passes by on its way to Colombo.

"On the left-hand side of the diorama is the Commercial Canal which connects the town with the backwaters. *Wallams*, the country boats, may be seen on the canal. On its left bank are Darragh Smail & Company's godowns and the Custom House. On the right bank are the customs buildings and warehouses.

"In the left foreground, standing in the midst of mango and 'flame of the forest' is the Imperial Bank of India.

"The travellers' bungalow with annexe and outhouses, Government *godowns* and the Public Works Department workshops are also represented.

"On the extreme right is the signal station and the flag mast, from the top of which flag signals are given to ships in the harbour.

"The open space near the signal station is the *maidan*, or recreation ground, characteristic of Indian towns."

In the special fitting above the showcases in the Hyderabad Court have been installed the first eight of a series of illuminated coloured transparencies, the subjects being as follows: A street scene, Hyderabad; In the fruit bazaar; A fruit stall in street; The fort of Daulatabad; Char Minar, Hyderabad; The fort of Golconda; Cave No. 19, The Ajanta caves; The Palace, Hyderabad.

For the Burma Court three small dioramas have been constructed in the Imperial Institute Studio by Mr. Montague Black from funds donated for the purpose by the Burmah Oil Company Ltd. These are arranged together in one cabinet under the caption "Burma Oil—from field to consumer." They show (1) the Burmah Oil Company's field at Yenangyaung with its numerous derricks of steel which are used for installing and replacing the pumping gear; (2) the Company's refinery at Syriam, near Rangoon, where the crude oil is treated after its journey of 275 miles through a 10-inch pipe-line; and (3) one of the Company's oil tankers at sea conveying the refined oil to a depot in India for distribution to consumers.

The three dioramas are connected by a glass tube representing the 275 mile pipe-line, and in this tube bubbles of liquid are caused to circulate from the field to the refinery, and thence to the tanker. The colour of the liquid representing the flow of crude oil from field to refinery is dark brown, whilst the tube connecting the refinery with the tanker has bubbles of a very pale yellow to represent the refined oil product. The movement of the liquid in the tubes serves to arrest attention and is a novel device not hitherto used in the Exhibition Galleries. The whole exhibit impresses on the minds of children and laymen that great and costly engineering feats are involved in the production and preparation for everyday use of such a common commodity as petroleum oil.

Associated with the dioramas is an exhibit, also donated by the Burmah Oil Company, showing samples of products prepared from the crude oil comprising light oils; lubricating

and batching oils; "malariol," an oil for spraying water to prevent the breeding of mosquitoes; bitumen for road surfacing; and paraffin wax for candles, grease-proof papers and cartons, matches, etc.

The labels of these dioramas read as follows:

(1) *The Burmah Oil Co.'s Field*

"This scene represents a portion of Yenangyaung oilfield, one of the oilfields operated by the Burmah Oil Co. in Burma, on the Irrawaddy river 275 miles above Rangoon.

"The buildings on the right background show the workmen's quarters with free hospitals and maternity centres, a labour bureau and other welfare facilities.

"The oil is raised from the wells, sometimes 8,000 ft. deep, by electrically-worked pumps operated from the surface by rods. The wells are generally drilled by electric power supplied from the Company's power station. A derrick or rig stands over each well for installing or replacing the gear.

"The oil from the wells flows through pipes to the collecting tanks on the river bank, where it is pumped 275 miles to the refining works at Syriam, near Rangoon, through a 10-inch pipe-line with a normal throughput of 240 Imperial gallons a minute."

(2) *The Burmah Oil Co.'s Refinery at Syriam, near Rangoon*

"This refinery, operated by the Burmah Oil Co. is situated on the bank of the Pegu river. On the opposite bank is Rangoon with the Shwe Dagon pagoda in the background.

"The crude oil is here refined into numerous products illustrated in the adjoining showcase.

"The refining plant, with its fresh-water tanks, may be seen in the mid-foreground: further back are the storage tanks in which refined spirits and oils are stored awaiting distribution throughout Burma and India.

"A large number of these tanks are also used for the storage of crude oil from the fields."

(3) *An Oil Tanker*

"This is one of the Burmah Oil Company's tankers engaged in transporting refined oil products to various ports in India."

The statuette of Count Mahé de Labourdonnais by Mr. Herbert Cawood which has been installed in the Mauritius

Court is a new addition to the collection of statuettes of men prominent in the history of Empire countries which is being formed in the Galleries. This addition has been made possible by a grant from the Mauritius Legislature, which voted the necessary funds and also assisted with photographs of the statue of Labourdonnais which stands in the Place d'Armes at Port Louis.

The statuette occupies a commanding position overlooking the Mauritius Court on the flight of steps leading from the East Gallery to the North Gallery where the Court is situated. (See Plate VII.)

The descriptive label for the statuette is as follows:

Bertrand Francois Mahé de Labourdonnais (1699-1753)

" Born at Saint Malo on 11th February 1699, Labourdonnais went to sea as a boy and entered the service of the French East Indian Company as a lieutenant in 1718. Six years later he was promoted captain and so distinguished himself at the capture of Mahé, on the Malabar coast of India, that the name of that town was added to his own.

" After two years' service under the Portuguese at Goa, he returned to the French service in 1735 as Governor of the Île de France (Mauritius) and the Île de Bourbon. His five years' administration was vigorous and successful. He suppressed the maroons, as the runaway slaves were called, who had been terrorizing the settlers, made good roads through the Island, built docks and repaired the forts, and firmly established agriculture and commerce. He was also responsible for the move of the capital from Port Bourbon to its present position at Port Louis.

" The introduction of sugar-cane into cultivation in Mauritius is credited to him, though the Dutch had grown it on a small scale whilst in occupation of the island; and he experienced great difficulty in persuading the inhabitants to adopt sugar cultivation in preference to cloves, indigo, coffee, cotton and cereals. When the importance of sugar cultivation was eventually realised, it rapidly became the paramount crop in Mauritius. Manioc (tapioca) was also introduced during his governorship.

" On the outbreak of hostilities between France and Great Britain in 1740 Labourdonnais was placed in command of the French Fleet in Indian waters. He saved Mahé, relieved Dupleix at Pondicherry, and in 1746 took part in the siege of Madras. He quarrelled with Dupleix over Indian affairs and was further aggravated by finding on his return to the Île de France that Dupleix had installed a successor in his place. He then sailed in a Dutch ship for France to present

Bertrand François Mahé de Labourdonnais.

A Bronze Statuette in the Mauritius Court of the Exhibition Galleries of the Imperial Institute.

PLATE VIII

MUSTERING SHEEP AT A SHEEP-SHEARING STATION IN AUSTRALIA.

Reproduced from a Diorama in the Exhibition Galleries of the Imperial Institute.

facing page 505]

his case at Court but was captured by the British, who allowed him to proceed to France on parole. In 1748 he was arrested and secretly imprisoned for over two years in the Bastille on charges of peculation and maladministration; was eventually tried in 1751 and acquitted. Prison confinement and his many personal anxieties had broken his health, and he died at Paris on 9th September 1753.

"The island of Mahé in the Seychelles was so named after Labourdonnais."

Samples of chopped wattle bark and wattle extract, together with specimens of leather tanned with Kenya wattle as an ingredient of the tanning solution, have been received from The Forestal Land, Timber and Railways Co., Ltd., as additions to the Kenya wattle exhibit displayed in the East African Court. For this Court photographs for use in the travelogue of Uganda have been enlarged from negatives kindly loaned for the purpose by Mr. E. F. Martin, of the Department of Agriculture, Uganda; a window in the Court has been fitted with three transparencies illustrating the Zanzibar fishing industry, and the Zanzibar clove industry exhibit has received photographic additions from negatives kindly loaned by Mr. F. B. Wilson of the Department of Agriculture, Zanzibar. A sample of clove stem oil distilled in Zanzibar, received from the Department, has also been added to the clove exhibit.

Two enlarged photographs of a passion fruit plantation in East Africa have been made from negatives kindly loaned by H.M. Eastern African Dependencies Office, London, and are now on view with the passion fruit exhibit.

The Institute is greatly indebted to Viscount Bledisloe for his generosity in lending the negatives he secured when he visited East Africa as Chairman of the Rhodesia-Nyasaland Royal Commission. From these negatives excellent transparencies have been made for the windows of the Rhodesian Courts and enlargements for travelogues. These pictures now form an important feature in the Rhodesian and East African Courts.

Further progress has been made with the work of installing the exhibits received from the British Empire Exhibition, Scotland, in the West African Courts. The story of West African hides and skins is the subject of one of these exhibits which is nearing completion.

A series of shipping grades of tin concentrates received from The Associated Tin Mines of Nigeria, Ltd., has been added to the Nigerian tin exhibit.

For the Cyprus Court, from the Cyprus Government, through their London office, have been received series of

enlarged photographs and collections of specimens covering carobs, citrus fruit, viticulture, olives and tobacco. These items provide the basis for excellent story exhibits of the main agricultural industries of the island.

An important addition to the Canadian Court is a bronze replica of the statuette of General Wolfe which is in the office of the High Commissioner at Canada House. This statuette occupies a position in the Canadian Court near the diorama of Quebec. The label affixed to the pedestal reads as follows:

General Wolfe

(1727-1759)

The Captor of Quebec

"James Wolfe, son of Colonel Edward Wolfe, one of Marlborough's veterans, was born on January 2, 1727, at Westerham, Kent. He was appointed ensign to the 12th Foot (now the Suffolk Regiment) in 1741. The following year he went to the Rhine with his regiment and gained great distinction at the battle of Dettingen in 1743, for which he was promoted lieutenant. In 1747 he was made a captain in Barrel's Regiment (now 4th King's Own) and was in most of the important battles of the next few years, attaining the rank of lieutenant-colonel in 1750.

"After the outbreak of war with France in 1757, Wolfe was ordered to America, and as Brigadier-general under General Amherst he took an important part in the capture of Louisbourg, July 27, 1758, his energy and military skill contributing to the speedy fall of the fortress. He then returned to England to recruit his health, which had been undermined during these operations.

"After a short rest he again went to America to take part in the expedition against Quebec. The force sailed from Louisbourg on June 1, 1759. Montcalm was in command of the French, who were strongly entrenched at Quebec, and every effort of Wolfe to draw him from his defences failed. With the help of the navy Wolfe then sailed past the city and succeeded in finding a point where the heights could be climbed, which enabled him to deploy his army on the 'Plains of Abraham,' so named after Maitre Abraham Martin who owned most of the land there. Wolfe moved up during the night, and on September 13, 1759, he fought a decisive battle with the French, who were defeated, after which Quebec capitulated. General Wolfe died on the battlefield, but knew of the victory before his death. The French commander, Montcalm, was mortally wounded and died in Quebec shortly after the battle."

The large map of Canada which formerly occupied a prominent position at the south end of the Canadian Gallery, near the West Entrance, having become out of date with the lapse of time, has been replaced, through the courtesy of the Director of Canadian Government Exhibitions and Publicity, by a new pictorial map of the Dominion specially drawn for the purpose.

The new map, which measures about 14 ft. × 7 ft., is primarily a modern political map of the country showing provincial boundaries, rivers, steamship, railway and air routes, etc., to which have been added pictorial symbols indicating the positions of the principal mines, coal and oil fields; farming, fruit growing and timber areas; hydro-electric power plants; meteorological stations and Royal Canadian Mounted Police posts, and other localities of interest. But the most attractive feature of all are miniature but beautifully executed cameos of Canadian life which are dotted about the map in appropriate places. The chief cities, besides being named and localised, are shown by some characteristic building, the National Parks by some typical examples of scenery; while the principal animals and fish all find illustration in full colour in the parts which they frequent.

The map is hand painted in delicate colours and it well deserves the very close scrutiny which it will undoubtedly receive.

Three specimens of pitchblende (radium ore) obtained from the Great Bear Lake deposits in Northern Canada and kindly presented by the owners of the mine, Eldorado Gold Mines, Ltd., have been placed on exhibition. Following their discovery in 1930, these deposits have since proved to be the largest in the world, and the refining of the ore for the extraction of the radium has now become an established industry in Canada. Indeed, the Canadian production is making this rare element available to hospitals at prices substantially lower than those formerly prevailing.

Also to the Canadian Court has been added, through the kindness of Messrs. Evans Brothers, Lescher and Webb, a collection of the various salts illustrating the use of bismuth in pharmacy.

The exhibit illustrating the rubber manufacture of Canada has been greatly improved by recasting on story lines and by the addition of fresh examples of rubber waders, rubber-soled sports shoes, and rubber soles and heels, manufactured in Canada from imported raw rubber, and kindly provided by the Dominion Rubber Company through the courtesy of the British Rubber Publicity Association.

For the British Guiana Court has been received from the

Colonial Secretary a set of photographs illustrating the gold and diamond industries.

To the Fiji Court have been added enlarged photographs depicting dairying, pig rearing, native life, etc., from negatives loaned by Mr. C. R. Turbet, Senior Veterinary Officer, Suva, Fiji; and two mats, one of woven pandanus leaf decorated with a shell border, the other of tapa cloth with a stencilled mangrove dye design, presented by Mr. H. R. Surridge, Agricultural Officer, Fiji.

Enlarged photographs illustrating gold dredging in New Guinea have been presented for exhibition in the Papua and New Guinea Court by Mr. C. A. Banks, of Bulolo Gold Dredging Ltd. Other enlargements showing sluicing for gold in New Guinea have been made from prints lent by the Bulowat Sluicing Syndicate.

A commencement has been made with the rearrangement of the Australian Court. Several carbon transparencies depicting economic activities, capital towns and ports, and country scenery have been installed in the windows round the Court. The mineral section has been rearranged on the story method, and for this purpose vertical showcases have been substituted for the flat table cases.

A diorama representing a large sheep-shearing station in the shearing season has been designed and constructed in the Imperial Institute studio by Mr. A. J. Carter, and is now exhibited with the wool exhibits in the Court, and associated with the portrait of John MacArthur, founder of the Commonwealth's chief industry (see Plate VIII). The descriptive label attached to the diorama reads as follows:

Sheep-Shearing in Australia

" The Clip that Furnishes Australia's Richest Crop."

" Australia is the leading wool-growing country in the world, and wool is her most valuable export product.

" In the middle distance of the scene before us stands a large shearing shed. The shearers are busily engaged inside, the supply of sheep being maintained from the pens in the foreground by the aid of clever sheep-dogs. Beyond the shed can be seen pens of shorn sheep which have passed through the hands of the shearers.

" At the near end of the shearing shed is the wool room where the fleeces are trimmed and classified and finally baled. A lorry partly laden with bales of wool stands outside.

" It is late afternoon in the Australian springtime and the day's work is drawing to a close. Ready for the next day fresh flocks of sheep have been driven in to the station, raising

from the trodden grassland a typical dust cloud which partially obscures drovers and dogs. In the right foreground is a drover with his dog surveying the scene spread out before him.

"On the hilly sides of the valley can be seen the remains of the eucalyptus forests which formerly covered the area. Many of the trees have been killed by ringing the bark, and these stand bleached white in the sun.

"On the horizon, in the extreme distance, stands the colourful ridge of the Blue Mountains."

Temporary Exhibitions.—Two exhibitions of a temporary nature have been held in the Exhibition Pavilion. One of these, which lasted from June 27 to July 31 comprised about 50 pastel portraits by Kathleen Shackleton, sister of the explorer, Sir Ernest Shackleton, of men and women who live and work in northern Canada. The portraits were commissioned by the Hudson's Bay Company (incorporated May 2, 1670) and were loaned by the Company for the period of the exhibition.

In her search for suitable character studies Miss Shackleton travelled some thousands of miles, sometimes to the cities, often to the remoter areas where trapper and trader meet. The result is a unique collection of portraits of the various types of Englishmen, Scotsmen, Irishmen, Frenchmen, Indians, Esquimaux and mixed races identified with the Company's commercial ramifications, and representative of the hardy pioneers who are assisting to develop Northern Canada.

A collection of paintings and drawings by Mrs. R. A. Wilson depicting village life in the Central Provinces, India, formed the second exhibition, which opened on August 8. This display comprised forty-six pictures, including oils, water colours and pencil drawings illustrating scenes of village life in the Central Provinces such as women at the well, a congregation at the village temple, a group of villagers at the village tank where they bathe, wash their clothes and water their cattle. The exhibition closed on September 8.

Lantern Slides of Empire Subjects.—The Imperial Institute recently accepted an invitation from the Victoria League to take over the League's collection of about 10,000 lantern slides of the Empire for circulation to schools and other educational organisations in the United Kingdom, and this service will be linked up with the parallel facilities afforded by the Empire Film Library in respect of Empire films. By

this means, coupled with the facilities offered by the Cinema and Exhibition Galleries of the Institute, one centre will be responsible for work relating to visual instruction in connection with the Empire.

As the collection of Empire lantern slides is being revised and extended, in co-operation with the Dominion High Commissioners, the Colonial Empire Marketing Board, and Colonial Agencies in London, the preparation of a detailed catalogue is being deferred for the time being. Particulars of the slides available on loan, free of charge (subject to payment of carriage charges) may be obtained on application.

Colonial Visitors.—The following is a list of officers on leave from the Colonies, etc., who visited the Institute during the three months May-July 1939:

MAY

Lt.-Col. V. BEADON, M.C., Commissioner, Burma Civil Service.
W. G. CRAWFORD, Deputy Conservator of Forests, Burma.
J. R. CURRY, Agricultural Officer, Tanganyika Territory.
E. W. EVANS, C.M.G., Colonial Secretary, Mauritius.
C. W. L. FISHLOCK, Agricultural Officer, Uganda.
W. P. GASKELL, Inspector of Mines, Nigeria.
J. W. GRANT, Department of Agriculture, Burma.
W. VICTOR HARRIS, Entomologist, Department of Agriculture, Tanganyika.
T. HIRST, Senior Geologist, Geological Survey, Gold Coast.
R. E. MOREAU, Secretary and Librarian, East African Agricultural Research Station, Amani, Tanganyika Territory.
W. R. C. PAUL, Agricultural Officer, Ceylon.
H. SERVICE, Geologist, Geological Survey, Federated Malay States.
A. F. SKERL, Inspector of Mines, Tanganyika Territory.
C. R. TURBET, Senior Veterinary Officer, Fiji.
J. M. WATSON, Agricultural Officer, Uganda.
R. O. WILLIAMS, Deputy Director of Agriculture, Trinidad.

JUNE

J. B. ALEXANDER, Geologist, Geological Survey, Federated Malay States.
H. ATKINSON, Government Chemist, Cyprus.
G. W. BAKER, Government Analyst, Department of Health, Palestine and Transjordan.
V. A. BECKLEY, M.C., Senior Agricultural Chemist, Department of Agriculture, Kenya.
G. S. BLAKE, Geological Adviser, Development Department, Palestine.
T. L. BOWRING, Engineer, Public Works Department, British Honduras.
A. CAWLEY, Inspector of Mines, Tanganyika Territory.
B. C. G. CHARLES, Agricultural Officer, Nyasaland.
Captain J. O. CUTTERIDGE, M.B.E., Director of Education, Trinidad.
H. C. DOYNE, Agricultural Chemist, Nigeria.
D. E. FAULKNER, Veterinary Officer, Gold Coast.
S. GILLETT, Agricultural Officer, Kenya.
Dr. G. GRIFFITH, Soil Chemist, Department of Agriculture, Straits Settlements.
N. S. HAIG, Senior Agricultural Officer, Uganda.
Sir WILFRED JACKSON, K.C.M.G., Governor, British Guiana.
J. L. B. KINCAID, Senior Agricultural Officer, Nigeria.
V. LIVERSAGE, Agricultural Economist, Kenya.

JUNE (*continued*)

B. G. A. LOWE, Agricultural Officer, Federated Malay States.
E. F. MARTIN, Agricultural Officer, Uganda.
C. L. NEWMAN, Agricultural Officer, Federated Malay States.
Captain C. R. S. PITMAN, D.S.O., M.C., Game Warden, Uganda.
L. H. SAUNDERS, Acting Senior Agricultural Superintendent, Gambia.
G. F. SAYERS, Administrative Secretary, Tanganyika Territory.
T. A. STRONG, Conservator of Forests, Ceylon.
D. STURDY, Senior Agricultural Officer, Tanganyika Territory.
Sir ARMIGEL DE V. WADE, C.M.G., O.B.E., late Chief Secretary, Kenya.
R. R. WATERER, Conservator of Forests, Cyprus.
G. C. WHITELEY, C.M.G., Deputy Chief Secretary, Nigeria.
R. A. WHITTLE, M.C., Assistant Chief Secretary, Uganda.
F. B. WILSON, Department of Agriculture, Zanzibar.
Dr. R. R. LE G. WORSLEY, Biochemist, East African Agricultural Research Station, Amani, Tanganyika Territory.

JULY

R. J. BENSTEAD, Inspector of Plants and Produce, Gold Coast.
Sir ALAN BURNS, K.C.M.G., Governor, British Honduras.
J. W. COSTELLO, Assistant Conservator of Forests, Nigeria.
M. GREENWOOD, Specialist, Department of Agriculture, Gold Coast.
J. B. KINLOCH, Senior Conservator of Forests, British Honduras.
D. F. MACPHERSON, Veterinary Officer, Kenya.
A. H. MALPAS, Director, Colombo Museum, Ceylon.
A. McLEAN, Deputy Director of Agriculture, Burma.
A. E. J. McLEAN, Inspector of Schools, Burma Education Service.
E. F. PECK, Chief Veterinary and Agricultural Officer, British Somaliland.
W. C. ROOKE, Deputy Conservator of Forests, Burma.
C. R. STUART, Senior Magistrate, Uganda.
R. W. THORNTON, C.B.E., Director of Agriculture, Basutoland.

BULLETIN
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THE TRANSITION FROM PEACE TO WAR AT THE IMPERIAL INSTITUTE

By SIR HARRY LINDSAY, K.C.I.E., C.B.E.,
Director of the Imperial Institute

THE address, reprinted immediately after this Foreword, by courtesy of the Association of Special Libraries and Information Bureaux, was written before the outbreak of war. It describes the normal peace-time functioning of the Imperial Institute as a bureau for the collection and dissemination of technical information about the economic products of the Empire and as a centre of visual instruction in essential facts about the life, scenery, agriculture and industries of countries of the Overseas Empire.

On the outbreak of war, our staff was seriously reduced, partly by the absence of those who had joined up, partly by the drafting of half of our technical officers to one or other of the emergency Ministries, where their scientific knowledge and technical experience are being put to good practical account. It will be remembered, in this connection, that one of the functions of the Institute, as defined in the Imperial Institute Act of 1925 is : " To advise on the development of the resources of the Empire in raw materials in order that such resources may be made available for the purposes of . . . Imperial defence." With the staff which is left to us we are carrying on as best we can. We still continue to receive inquiries from Governments, technical officers and private producers and exporters of the Overseas Empire, aimed at the progressive development of the economic products in which they are

severally interested; and such inquiries are often, as in pre-war days, accompanied by specimens for examination in our laboratories and report to the inquirers.

Shortly after the outbreak of war we found it necessary to close our Exhibition Galleries and Cinema, for want of a convenient air-raid shelter in the immediate vicinity of the Institute. But this omission has now been rectified. A shelter available to the general public has been provided within a couple of hundred yards of our East Entrance, and as a result we hope before long to be able to reopen the Galleries, and later on, if the experiment proves successful, the Cinema as well. Meanwhile the Curator and his staff are working hard to introduce many improvements to the exhibits in the various Empire Courts—improvements which we have long had in mind but which have had to be kept in suspense for just such a rainy day as this. Thus, when the Galleries do reopen, we shall be able to show our visitors many exhibits of the Overseas Empire which will be new to them and which tell more effectually than before the "stories" which it is our function to display.

At first, on the outbreak of war, the bookings of films of our Empire Film Library with schools and societies of the United Kingdom were indefinitely suspended. Gradually, however, as the evacuated school children settled down in their new quarters, and school teachers were able to recover projectors left behind or to borrow others, the bookings were resumed, and we are now as busy as ever. The issue of a new and up-to-date edition of our Empire Film Library Catalogue has been made just in the nick of time, for our films are popular with all school teachers owning projectors, and they are encouraged to find many recent and popular films listed in the new Catalogue.

Thus, in our many and varied activities we look forward with confidence to the future, assured that Empire Governments will continue to rely upon the Imperial Institute for the scientific and technical as well as the educational facilities which we were founded and equipped to supply. For if the development of the material resources of the Empire is a vital responsibility during the war, it will be an equally urgent responsibility during the economic malaise which, sooner or later is bound to follow the restoration of peace. If the last

war taught us anything in the economic sphere, it was that the pressure of war demands and the artificial values accorded to the raw materials of war leave a bitter aftermath in the dislocations and readjustments which accompany the reversion to conditions of peaceful trade. The first becomes last and the last first. What was of primary value during a war, in quantity or quality or both, becomes secondary; and on the other hand the demands of peaceful trade at once discover shortages which encourage production and, in turn, over-production. When the present war opened we were only beginning to envisage conditions in which the primary producer was winning slowly and desperately back to the stage of profitable production. Now that war is upon us again, it behoves us to make wise and far-sighted plans for future development. The success of these plans depends on one essential factor, namely, the application of scientific methods. All economic development, if it is to succeed, must take careful account of the natural conditions underlying production, processing, transport and marketing. In other words, science is the secret of success, and only the careful recognition and strict application of scientific methods will ensure the development of our material resources on profitable lines.

In the educational sphere, again, it is wise to take careful account of scientific methods of which not the least important is that of visual instruction. In the lay-out of our Exhibition Galleries and the collection and arrangement of the exhibits in the Empire Courts, in our Cinema and in the circulation of our Empire Film Library and lantern slides, we try to keep abreast with the latest developments in the art of presenting scientific facts artistically.

It is exactly in these spheres of scientific and technical advice, and of visual instruction, that the Imperial Institute is best qualified to assist the Governments of the Empire. With these objects it was founded, and these objects it continues faithfully to serve.

THE IMPERIAL INSTITUTE AS AN INFORMATION CENTRE

By Sir Harry Lindsay, K.C.I.E., C.B.E.
Director of the Imperial Institute and *President of the Association of Special Libraries and Information Bureaux.*

Presidential Address prepared for The Sixteenth Annual Conference, 1939, of the Association of Special Libraries and Information Bureaux; and reprinted by permission of the Association.

I have been asked, in this address, to give some account of the work of the Imperial Institute; and, indeed, I know of no institution better qualified to furnish material for just those studies which are germane to the work of this Association, for the Institute is itself, on its scientific and technical side, an Information Bureau, with interests which are Empire-wide and sources of information which are world-wide. Moreover, it possesses a Library which is "special" in the sense that it does not attempt to cover the range of the ordinary lending library but caters for specialists in the technique of raw materials, their sources, production, processing and trade. The raw materials we are called upon to handle and advise upon are of Empire origin; yet we must also keep an eye on those of foreign origin, for comparative and competitive purposes. That is why, as I said above, the interests we serve are Empire-wide, but the sources of our information must also be world-wide.

But I think I can fairly assert one more claim to the attention of an ASLIB audience; not merely on account of our information bureau, with its special library, but also on account of the educational work carried out through our Exhibition Galleries, Cinema, Empire Film Library and Empire Lantern-slides. In other words, whilst our primary function is to collect and disseminate technical information regarding the resources of the Empire, animal, vegetable and mineral, we are also called upon to furnish general information about the Empire, particularly its geography and its economic products, and chiefly for the use of schools. The Information Bureau, at this point, leaves the domain of the written word and passes to the domain of visual instruction. We find

ourselves here in a realm where Science allies itself with Art; and, indeed, there is no more difficult technique, nor one which produces happier results, if successful, than the technique of presenting scientific facts artistically. However, for the purpose of this address, our effort to provide visual instruction in the geography and economic resources of the Overseas Empire, is secondary to our function as a Special Library and Information Bureau; so let first things come first.

Before going further, let me, in as few words as possible, sketch out the programme for this talk, the angles from which I propose to attack my subject. First, I propose to give some account of the Imperial Institute itself and, particularly, of the functions which we are called upon to perform, at whose bidding and in whose interests—these will be answers to the question why the Imperial Institute exists. Second, what are our resources and methods—in other words, how the Institute functions. Third, what results are achieved? Why, How and What, are the questions, and now for the answers.

The Imperial Institute was founded in 1887, and completed in 1893 as a great national memorial of the Golden Jubilee of Queen Victoria. Not only the United Kingdom but also many countries of the Overseas Empire contributed the £400,000 required for its construction and endowment. King Edward VII, then Prince of Wales, was the first President of the Institute, which in his own words was intended "to promote the utilisation of Empire products and to make better known the life, resources and the industries of the various countries which comprise the British Empire." This primary character of a clearing house of information about the resources of the Empire, the Institute has never lost. The following is an account of the actual tasks set before us, as summarised in the Imperial Institute Act of 1925:

(1) To promote the commercial, industrial and educational interests of the Empire.

That is a pretty wide instruction, in all conscience! But in case there should be any misunderstanding as to its scope, there follows:

(2) To collect and disseminate the following classes of information:

(a) Possible uses of and markets for new raw materials;

(b) New uses of and markets for raw materials already known;
(c) Sources, production, supplies, cost, consumption and requirements of raw materials and legislation relating thereto;
(d) The best means of increasing supplies or of creating new sources of supplies of raw materials within the Empire;
(e) The best means of treating them and of preparing them for marketing;
(f) Technical and scientific information bearing upon the industries of the Empire.

Throughout, the term raw materials is held to cover also semi-manufactured products. Note that it is only when we come to sources of supplies of raw materials and information about industries that the scope of the information is limited to the Empire. This limitation is, of course, quite natural. Information about raw materials is received from all sources, both Empire and foreign, but is to be applied in the interests of the development of the resources and industries of the Empire.

(3) To advise on the development of the resources of the Empire in raw materials in order that such resources may be made available for the purposes of industry and commerce and of Imperial defence.

Here the question of Imperial defence is mentioned for the first time and is brought definitely within the scope of objects before the Institute.

(4) To conduct in the laboratories of the Institute preliminary investigations of raw materials and when it may be deemed advisable to arrange for more detailed investigation by appropriate scientific or technical institutions.

This is important. It means that we are not called upon to undertake research, but to carry out investigational work of practical value in the execution of the duties assigned to us. Requests for research are passed on to institutions competent to undertake it.

(5) To collect samples of raw materials having a definite value in industry and commerce; and

(6) To co-operate with other agencies within the Empire formed for similar purposes.

These two duties are consequential and obvious. The second one means that we maintain close contact with technical departments of Governments and Administrations throughout the Empire. Those which concern us most closely are naturally those which deal with Agriculture, Forestry, Fisheries, Veterinary Science, Geological Surveys, Mining, and Chemical Industries. Technical officers of the Overseas Empire, home on leave or deputation, are always invited to visit the Institute. We find these visits most helpful and the officers themselves are understood to benefit by the knowledge they thus gain of the facilities available to them in the Laboratories and Information Offices of the Institute. The popularity of these visits may be gauged by the fact that whereas during the whole of 1938 the number of officers thus visiting us from technical departments of the Overseas Empire was 110, the number during the first six months only of the year 1939, has been 91.

(7) Finally, to maintain for public information and instruction in the Exhibition Galleries of the Institute exhibitions illustrative of the resources and development of the Empire and of its life, scenery and progress and where practicable to organise from time to time temporary exhibitions of a similar nature elsewhere.

This relates to our activities under the head of Visual Instruction in the Empire, which I mentioned briefly in my introduction and to which I shall have occasion to refer again, later.

I hope I haven't bored you with this list of the why's of our existence. I thought it advisable to describe them in some detail partly because they are necessary to a proper grasp of the scope of our information work, partly because they explain the range and variety of the methods which we have to employ.

Now I turn to the more interesting account of How we work ; in other words, what are our resources and what is the machinery we employ.

So far as the actual task of administration is concerned, this is defined in terms of the Imperial Institute Act of 1925. We are not a Government Department but an institution

responsible to Parliament through the Department of Overseas Trade whose Secretary, the Rt. Hon. R. S. Hudson, M.P., is President of our statutory Board of Governors, while Sir Quintin Hill, K.C.M.G., O.B.E., the Comptroller-General of the same Department, is Vice-President. Representatives of the Treasury, Board of Trade, Colonial Office, Ministry of Agriculture and Fisheries and of the Department of Scientific and Industrial Research are Governors; also representatives of the Dominion and Indian Governments and of scientific and commercial interests. I was appointed Director nearly five years ago. Our finances are derived from contributions made to us annually by the United Kingdom, Dominion, Indian, Burma and Colonial Governments. The Indian States of Hyderabad, Mysore, Travancore and Cochin also contribute.

But we are chiefly concerned to-day with the technical and scientific aspects of our work. From this point of view, the Institute may be regarded as a great Information Bureau with a staff of some forty scientists. For the sake of convenience, the Bureau is divided into two main Departments, one to handle inquiries relating to Plant and Animal Products and the other Mineral Resources. Each Department has its own laboratories, intelligence offices, and indexing staff. There is a single Statistical Section serving both Departments. The Library also serves both Departments, although for the sake of convenience the volumes dealing with Mineral Resources are kept separate from those in our general Library. This arrangement is due to the fact that the old Imperial Mineral Resources Bureau, organised as a separate entity in 1919 as a result of lessons gained from the experience of the Great War, was amalgamated with the Institute in 1925 to form the nucleus of our Mineral Resources Department, and has retained its own separate library ever since.

But before I describe the scope and objects of the Library, let me first say something of the Institute as an Information Bureau. It is the Library, after all, which serves the Bureau, rather than the Bureau the Library. And, of course, the Bureau is also served by the Indexing and Statistical Sections. Yet I must frankly admit that although the primary function of the Institute is that of an Information Bureau, I am straining a good deal the meaning of the word Bureau in applying it to the Institute. Imagine to yourself, please, a Bureau which

has its own laboratories, its own compilers and its own publications; and you will realise at once the risk of misunderstanding. For in common parlance a bureau, when it isn't a handy piece of furniture, is the kind of office which collects and disseminates information—a sort of "broker" among offices, which puts the seeker for information in touch with sources of supply. But we are not just brokers, we are not even just merchants, for we are busy also creating from our own investigations results which we pass to the client who asked for the investigation to be done (and who in nine cases out of ten sent us the materials to be analysed or tested); results which we also store in our records and, if worth while, publish in our monographs or in our quarterly BULLETIN, to be dispensed to other inquirers should the latter materialise. I don't say that some of this information specially collected in response to special demands is not kept confidential. It certainly is, at request. But requests for results to be kept confidential are on the whole uncommon; and most of our results are of a character which is not confidential—indeed many of them are, as I say, published in our monographs or in our quarterly BULLETIN.

And now a word as to the sources and scope of our inquiries. I hope I have not emphasised our laboratory work unduly or given the impression that most of our inquiries involve chemical tests. That is by no means the case, for by far the greater proportion of our inquiries are simply for information regarding raw materials, their qualities, prices, supplies and demands, markets and so on; it is the minority which come linked with a particular specimen or sample demanding chemical investigation or mechanical test in our laboratories. In any event, whether laboratory work is or is not required, the inquiries come to us from a very wide variety of sources. It may be the technical department of a Government of the Empire—Home or Overseas—it may be a farmer or planter of the Overseas Empire, or a mining or timber concessionaire who is anxious for help to market his produce; it may be a merchant or manufacturer in this country who has hitherto handled produce of foreign origin and wishes to tap new sources of supply within the Empire; it may be a scientist or consultant who wishes to know if our results coincide with his own. Then again the character of the inquiries varies within a very

wide range. Sometimes it is a request for identification; or we may be asked to what uses certain products are put, or for advice as to new uses, advice as to the best kind of machinery for processing, or the best method of packing; or again for advice as to new sources of supply within the Empire. I hope I have said enough to show how widely different are the sources and character of the inquiries we receive. I do not wish to overstress the point, although it is important to a proper grasp of the character of our work. Let me just add, by way of illustration, a list of some of the raw materials with the countries concerned, dealt with at the Imperial Institute during the past month: Cassava products from St. Lucia; Vanilla from Grenada; Preserved Ginger from Jamaica; Citrus and Pineapple juices from Nigeria; Grapefruit juice from the Gold Coast; Cashew nuts from Ceylon; Drug cultivation from Kenya; Cinchona from British Honduras; Tung nuts from the Union of South Africa; Tobacco extract from Southern Rhodesia; Mangrove wood for paper-making from Tanganyika; Beeswax and Eucalyptus oil (the latter for ore flotation) from Northern Rhodesia; Radium minerals from Canada; Iceland spar from the Union of South Africa; Titanium white pigment and Clay for aluminous cement from Ceylon; Diatomite and Asbestos rock from New Zealand; a rare mineral from the Gold Coast; Electromagnetic separation of minerals from the Federated Malay States; Building stones from Nigeria; Chromite from Sierra Leone; Vermiculite from Tanganyika; Bituminous material from Palestine.

How do we get the information to answer these widely varying questions relating to widely different products? First and foremost from the accumulated experience of nearly fifty years of such work at the Institute. I think it can safely be said that no other body doing work of this nature can claim such a long record. The next important thing is personnel. We have still on our staff highly trained scientific officers who have been engaged in these tasks for thirty or thirty-five years. Such experience is obviously of inestimable value. Our staff comprises University graduates either with training in one of the fundamental sciences concerned with economic products such as chemistry and botany or mineralogy or with commercial or industrial experience.

In carrying out these investigations we are fortunate in having the help of two Advisory Councils, one on Plant and Animal Products, with Sir Frank Stockdale, K.C.M.G., as its Chairman, and one on Mineral Resources under Sir William Larke, K.B.E. The two Councils control the activities of fifteen Consultative Committees dealing with the following major groups of raw materials: Timbers, Vegetable Fibres, Oils and Oilseeds (with a Sub-committee on Tung Oil), Essential Oils, Gums and Resins, Tanning Materials, Hides and Skins, and Insecticide Materials of Vegetable Origin; and on the minerals side—Precious Metals, Base Metals, Coal and Petroleum, Iron and Ferro-Alloys, Chemical Industries, Miscellaneous Minerals, and Mining Law. On these Councils and Committees the United Kingdom, Dominion, Indian and Colonial Governments are represented, as well as commercial and industrial interests and scientific circles. Thus business men, scientists and administrators meet in our Conference rooms and discuss with us the various technical problems which reach us from all over the Empire; they also assist us from time to time with information and material required to enable us to compile and publish our technical monographs and our quarterly BULLETIN. Technical Officers of Overseas Governments are also invited to attend our Committees when their own problems are under discussion. This is team work of a high order and, without the help of these teams, we should find it difficult or impossible to meet from our own technical experience and skill all the demands made upon us. I should add that, in all our scientific and technical work, we co-operate closely with the High Commissioners and with the Colonial Office, and, on the marketing side, with the Colonial Empire Marketing Board.

I now turn to describe the work of our Special Library. May I digress here for a moment to make some general observations on the modern tendencies to which we are committed in building up and maintaining a specialist library of the character necessary to serve the objects we have before us?

Before the war it was fairly easy to maintain a library such as ours. The kind of technical works which we had to acquire were not nearly so numerous as they are now; and, above all, the number of technical journals (as distinct from text-books and other books) was much less—more books and

less journals. Nowadays the balance has shifted. We are forced to rely more on journals and less on books. The fact is that as Science advances it is bound to become more and more departmentalised, for only by means of increasing specialisation can the intelligence of man grapple adequately with the scientific problems which his own intelligence has raised. Specialisation evokes the problems, and only specialisation can find the answers.

The result is that whereas, before, our scientific staff had to read widely amongst scientific books of reference, nowadays they have not only to read such books but also to keep abreast with the latest articles in technical journals ; not only journals in English but in foreign languages as well. The method employed is to circulate the journals amongst the staff, each member concentrating on those which bear on his special subjects, and marking the articles which are likely to be of more or less permanent interest. After the journals have been marked they pass to our indexers who have to be fully qualified both technically and linguistically for their work. They enter the references in the card-index and also, from their own technical knowledge, and from the monthly abstracts of current work, enter up any other articles, not marked by the laboratory or intelligence staff, which are likely to be useful. Our card index, which for the convenience of the staff is arranged under subject headings, by commodities, was begun some forty years ago, and the mass of information which can thus be made available at short notice is amazing. The BULLETIN, which contains articles and notes summarising the results of investigations in our laboratories or of trade inquiries which we have dealt with, as well as technical reports of Empire or foreign sources, has for thirty-seven years served as an invaluable means of disseminating information about commercial products of the Empire ; the extensive bibliographies which it provides are of great value. In addition the technical monographs compiled at the Institute provide detailed, up-to-date information of the classes of products which form the basis of our work. Our mineral monographs, over fifty in number, are revised and more usually completely re-written from time to time as required. Each volume of this series deals with a particular mineral or with the ores of a particular metal or with a group of minerals of similar appli-

cation, such as gemstones or abrasives. A new monograph on Chrome Ore and Chromite will shortly issue. On the plant and animal products side, we have recently published a monograph on the preparation of hides and skins of the Empire, and we have almost ready for publication a monograph on Insecticide Materials of Vegetable Origin.

By this means we maintain an Information Bureau very comprehensive in character, as indeed it must be to enable us to advise on the wide range of economic products with which we are called upon to deal.

As an indication of the scope of our Special Library and Information Bureau, let me quote the following figures: The total number of books in our Library is 75,250 volumes. We acquired last year, by purchase or gift, of books and other non-periodical publications 4,170 volumes. We receive each year some 900 periodicals comprising altogether some 26,000 separate issues. Of the 900 periodicals, the number of dailies and weeklies is 150, of which nearly one half are United Kingdom in origin, nearly one-third Overseas Empire, and nearly one-quarter Foreign. Of the 600 monthlies and quarterlies, nearly one-third are United Kingdom, nearly one-third come from the Overseas Empire, and over one-third are Foreign. Finally, we receive a number of miscellaneous periodical publications, e.g. all the annual reports of the Dominion and Colonial Governments, and their Gazettes, as well as many market reports, both British and Foreign.

Statistics play an important part in our work, but these need expert interpretation if one is not to be led astray by them. We have a special section for this work, which ensures that all doubtful statistics are closely scrutinised before being accepted, for there is nothing more misleading than undigested statistics. Not only do we collect and collate from the annual returns received from official sources but we also secure many interim statements which are of considerable service to the Institute and its inquirers particularly as the printed annual statements do not reach us until many months after the close of the year. Our most important piece of statistical work is the production of our Annual Statistical Summary of the Mineral Industry of the British Empire and Foreign Countries. This annual volume of about 450 pages gives the production, imports and exports of most minerals and metals throughout

the world, and has, I think I may claim, an international reputation.

The Laboratories and Intelligence Sections of the Institute work in close co-operation in an endeavour to supply inquirers with the fullest and most useful information. After a sample has been examined in the Laboratories, the results are very often discussed with the Intelligence Staff, and from this collaboration it is frequently possible not only to give an inquirer a definite opinion regarding the quality or value of a product, but also to suggest means of improving its quality and the best means of finding an outlet for it. If a commercial valuation of a material is necessary, the Intelligence Staff from their knowledge of market requirements are able to suggest the most suitable commercial firms to which samples should be submitted for opinion. In this way the potential producer is given the greatest possible assistance.

In conclusion, I venture to say a few words about our educational work at the Imperial Institute. Here we leave altogether the domain of the Special Library, but not altogether that of the Information Bureau. Perhaps the best description of this side of our work is that of a Visual Instruction Centre of the Empire, for here we combine all the latest technique in visual instruction. Our Exhibition Galleries, our Cinema and Empire Film Library, our Lantern-slides, Lectures, illustrated Postcards and School Specimens, all tend to secure the one object, namely co-operation with school teachers in disseminating a more intimate knowledge of the geography, arts and industries of the Empire. Let me give a very brief account of each of these activities.

The Exhibition Galleries are four in number—East, West, South, and North—in all between one quarter and half a mile long. They are divided into Empire Courts, each country of the Overseas Empire being represented in its own Court; and they are so arranged that as you walk through the various Courts you follow the natural geographical sequence of the Dominions and Colonies. Canada occupies the whole of the West Gallery. Thence by Newfoundland and the West Indies you enter the South Gallery and pass by the Falkland Islands, New Zealand, Fiji and the other Pacific islands to Australia, Borneo, Sarawak, Hong Kong and Malaya; and so to the East Gallery comprising India, and the major Indian States,

Burma, Ceylon and Aden. Thence to the North Gallery for Mauritius and the Seychelles, Somaliland, the Sudan, East, South and West Africa and thus by Palestine, Transjordania and the Mediterranean Colonies, back again to Canada in the West Gallery. Each Court shows by means of relief maps, coloured transparencies and other pictures, dioramas, panoramas, models and specimens of animal, vegetable and mineral products, arts and crafts, charts, graphs and diagrams and other exhibits too numerous to specify, the life and scenery, the arts and industries of the country represented. In fact, we try to arrange the exhibits in such a way that each country tells its own story artistically and vividly, in its own Court.

The descriptive labels are printed in brief, simple language which both the child and the man in the street can easily read and understand. They are headed, where possible, by catchy captions to arouse the interest of the unwary or unsophisticated visitor and to concentrate his attention on the exhibit described. The facts and figures, in so far as they can be included in a short label, are culled from authentic sources, usually from blue books and other official publications received in our Library and statistical department ; and where possible the figures are shown in charts or diagrams.

It is, however, a well-known fact that things read make a less vivid impression on the mind than things seen, and for this reason we have adopted the diorama as a focal point to arrest attention and to create an interest in the associated story exhibits. Our aim has been to instal at least one diorama with its associated story exhibit in each Court ; this objective has been almost attained, and we now have more than 100 dioramas on view in our Galleries.

The subjects selected for dioramas are either a prominent natural feature of a country, a port or harbour or, more usually, a typical industry. To mention a few examples: dioramas are used in India to show Mount Everest, Cotton, Jute, Tobacco and Tea ; in Burma to show the Irrawaddy, Rice and Teak ; in Ceylon, Rubber, Tea and Coconut products ; in Zanzibar, Cloves ; in Rhodesia, the Victoria Falls, Copper-mining and Cattle-ranching ; in South Africa, Cape Town with Table Mountain, Gold and Diamond mines, Sheep on the Karroo, and Fruit and Wattle plantations ; in Malta, the Grand Harbour ; in Canada, Quebec, Wheat harvesting, Salmon

fishing, Nickel mining, and Lumbering; in the West Indies, Limes, Bananas and Cocoa; in New Zealand, the Hot Lakes, the Southern Alps, Sheep-shearing and Dairying; and in Australia, Sydney Harbour and the Yarding of Sheep.

These dioramas are constructed in the Imperial Institute Studios, and every care is taken to secure accuracy of detail by providing the artist with information and numerous photographs to work from, and by enlisting the co-operation of overseas officials and others with intimate local knowledge of the subject or scene portrayed. A diorama presents to the eye of the visitor a vivid picture that becomes fixed in his memory, and he is frequently stimulated thereby to investigate the exhibits arranged in association with the diorama and is led on to read the descriptive labels and often to make verbal inquiries of our Curators, Guide Lecturers, and Exhibition Officers.

So far as the development of natural resources is concerned, we are not content with merely showing specimens of ores or timber, oilseeds, gums or fibres. We try as far as possible to tell the whole story of the industry from the raw materials to the goods manufactured from them, thus linking geography with agriculture or forests or mines and again linking the Overseas Empire producer with the manufacturer whether he be a local manufacturer or of the United Kingdom. The child's imagination is caught by some object in simple domestic use such as a brush or a candle, cosmetics or silk stockings or soap. Its interest is aroused and it is encouraged to ask those essential questions which leap to the childish mind and which are at the base of all progress in education: "What is this?" "Why is it here?" "What is it made of?" "How was it made?" These are the questions which, as I say, we try first to stimulate and then to answer.

A Central Stand is maintained in a prominent position in the Galleries where visitors on making verbal inquiries of the Officer-in-Charge are put in touch with the appropriate technical departments of the Institute or with the specialist officers dealing with them.

One of the most important developments in our information services at the Imperial Institute during the past few years has been the rapid advance in the use of the film as a means of supplying data concerning the life and industries of the

Empire. I am glad to see that such an authority as Mr. Thomas Baird, with whom we have been working in close co-operation in this field, is to read a paper to the Conference on the use of the film in technical instruction, as I feel sure that with the increasing number of 16mm. cinematograph projectors becoming available to schools and societies of all kinds in this country, many technical libraries and information bureaux will find it worth their while seriously to consider the possibility of using the cinematograph film and other visual aids to instruction as a means of disseminating information of interest to their members.

The Imperial Institute Cinema and the Empire Film Library may be dealt with together. Our Cinema Hall was built for us in 1926 by the Empire Marketing Board, of happy memory: it has room to seat nearly 400 persons. Two years ago we installed "sound" projectors, and the experiment has been successful. The films are presented to us by authorities from all over the Empire, by Ministries and Departments of the United Kingdom Government, by local authorities, public utility and commercial and industrial companies, and by Governments, companies and individuals of the Overseas Empire.

Our library of 1,500 Empire films has thus been built up, after making due provision for wear and tear, from a nucleus of some 750 which we inherited from the Empire Marketing Board by courtesy of the Postmaster-General to whom they first passed on the demise of the Board. These films are not only shown in our Cinema, but are also circulated on loan, free of charge save to recover costs of transport, to schools and societies throughout the United Kingdom. Similarly we circulate films of the G.P.O. Library, as agents for the Postmaster-General, and colonial films as agents for the Colonial Empire Marketing Board. During 1937 and again in 1938 we received grants from the Imperial Relations Trust for the purchase of new films for the Empire Film Library, and for the replacement of worn material. The total number of issues made during the first six months of 1938 from the G.P.O. and Empire Film Libraries was less than 15,000; during the same six months of 1939 the number of issues increased to over 22,000, representing audiences which ran into many millions, chiefly of school children.

Our system of lectures can be briefly described. We have two Guide Lecturers on our staff. They have first-hand experience of the Overseas Empire and are thus well qualified to explain the exhibits in our Galleries to our school-party visitors. Also, during the autumn and winter months, we are fortunate in securing by co-operation with the Institute of Education lecturers from the Dominions and Colonies who may happen to be in England on holiday or on study to come and give us lectures in our Cinema Hall, usually accompanied by lantern slides or films. If the old proverb is correct, that "Seeing is believing," then surely "hearing" in combination with "seeing" renders conviction doubly assured.

The Victoria League bequeathed to us quite recently their well-known collection of some ten thousand lantern-slides for circulation in this country; and we are at present discussing with the Royal Empire Society the conditions on which they would be prepared to entrust us with the handling of their slides and their circulation to schools. With the co-operation of High Commissioners, of London Agents for the Colonial Governments, and of other authorities, we hope to build up this valuable nucleus of some 10,000 slides into a most useful and informative collection; of private donors I mention particularly Lord Bledisloe, who has given us much help from his truly remarkable collection of New Zealand and Rhodesian photographs.

The Institute has already established itself as an authority on visual education on the Empire by means of its Exhibition Galleries, Cinema and Film Library, and the transfer of the slides will enable the whole work in this field to be centralised. I should, however, issue a warning that, although the old-fashioned magic lantern operating glass slides has been in existence for many years, still the cost of the slides and the risk of breakage in transport has restricted the development of libraries circulating slides. Considerable attention is now being given to the possibilities of a small projector which operates strips of non-inflammable film or small separate slides containing sections of cinema film ($1 \times 1\frac{1}{2}$ in.). These projectors are quite cheap, and a roll of strips can be supplied at approximately the cost of the carriage charges on the same number of glass slides. The film strip is, of course, unsuitable where the film cannot easily be replaced in the event of damage,

e.g. colour film, or where variations in the sets of pictures to be displayed are required. In such cases the film slide is employed, and it has the advantage over the normal $3\frac{1}{4}$-in. slide in that, even if the glass does break, the film usually escapes damage.

Our series of Empire postcards in packets of six or more with lecture notes and maps included, are in great demand by school teachers. Each series tells the story of some major industry of the Empire, such as Tea, Coffee, Rubber, Rice, and so on. Our School Specimens fill a long-felt need of some centre where school teachers can obtain, at the cost of packing and postage, specimens of economic products of the Overseas Empire not easily available in the shops. Both the postcards and the school specimens are used to illustrate the school lecture, often with the help of an epidiascope.

And now I have finished this account of the Imperial Institute in its threefold capacity as Information Bureau, Special Library and Visual Instruction Centre. May I conclude by expressing the hope that, on your return to London, members of ASLIB will do us the honour of coming to see us at work and will give me an opportunity of welcoming you personally and of explaining some of our more interesting problems and how we try to grapple with them ?

PLANT AND ANIMAL PRODUCTS

REPORTS OF RECENT INVESTIGATIONS AT THE IMPERIAL INSTITUTE

Selected from the Reports made to the Dominion, Indian and Colonial Governments

CURING OF TOBACCO WITH ETHYLENE AND ACETYLENE

EXPERIMENTS conducted in Germany and in Italy indicated that the quality of tobacco can be improved to some extent by curing the leaf in an atmosphere containing small amounts of ethylene or acetylene. The results of these experiments were published in two papers, one by Dr. G. Pfüster and Dr. H. Losch in *Die Umschau*, 1935, **39**, No. 11, 202-206, and the other by Dr. U. Rossi in *Bollettino Tecnico del R. Istituto Sperimentale per le Coltivazioni dei Tabacchi "Leonardo Angeloni," Scafati (Salerno)*, 1933, **30**, No. 4, 221-258. Summaries of these papers were prepared at the Imperial Institute and distributed to certain Colonies where tobacco is grown, and also published in this BULLETIN, 1937, **35**, No. 3, 359-363.

Preliminary experiments with ethylene at a concentration of 1 in 1,000 were carried out by the Department of Agriculture in Nyasaland in 1937, before the summaries referred to had arrived, and cigarettes made from the treated leaf were sent to the Imperial Institute for examination. Smoking trials showed that any improvement in flavour which had resulted from the treatment was almost negligible, but the leaf had been cured before being subjected to the influence of the gas,

and it is understood that further trials were to be made by the Department.

More elaborate experiments were made by the Department of Agriculture, Mauritius, in 1938, and seven samples of different varieties of tobacco which had been treated with acetylene were forwarded to the Imperial Institute, together with seven samples of the same leaf cured by normal methods. A preliminary note on the experiments, prepared by the Government Tobacco Officer, Mauritius, was also furnished, and is reproduced below, followed by reports on the samples examined by the Imperial Institute and a firm of tobacco leaf merchants.

I. Preliminary Note on Experiments in Mauritius in the use of Acetylene Gas in Curing Tobacco

Introduction

During the year 1938 the writer's attention was drawn to summaries of the papers on "The Improvement of German Tobacco," by Dr. G. Pfüster and Dr. H. Losch, and "The Treatment of Tobacco with Ethylene," by Dr. U. Rossi.

These workers state that the use of ethylene gas accelerated the process of curing and improved the aroma, colour and burning qualities of tobacco. Dr. Rossi also claimed that the ethylene treatment, by maintaining the turgidity of the cells, decreases the rate of drying of the leaf and so reduces the risk of the leaf drying out green when the weather is exceptionally dry or windy. From the summary of the above publications available to the writer it would seem that Dr. Rossi's work was confined to the use of ethylene gas, though Drs. Pfüster and Losch used ethylene, acetylene and nitrous oxide in their work.

The peculiar tang associated with Mauritius leaf led the writer to carry out the following experiments in an endeavour to ascertain whether there was any possibility of the pronounced tang being reduced by the use of acetylene gas. The experiments were conducted under normal working conditions in the flue curing barns at the Tobacco Station and not in specially prepared chambers. The quantity of leaf

placed in the barns was less than the normal quantity, as the available leaf was divided between two barns.

Acetylene gas was chosen for the experiments owing to the ease of application under normal working conditions and the reduced risk of accidents which might occur by the use of ethylene gas under pressure or the use of nitrous oxide.

Technique

Leaf at the normal stage of maturity was harvested by the priming method and strung on rods in the normal manner. In order to obtain an even distribution of the leaf between the experimental and control barn the rods, on being strung with leaf, were placed in each barn alternately. The leaf was harvested from trial plots of seven different varieties.

Both the barns used are of the same internal dimensions, viz. 12 ft. × 12 ft. × 16 ft. high, and the ventilators of approximately the same size. The cubic capacity of each barn was 2,300 cu. ft. During the experiments the barns were used alternately as control or experimental.

After the leaf had been placed in the barns the floors were sprayed with water to increase the humidity, as the atmospheric conditions were extremely dry, and the barns closed. Prior to closing the door of the experimental barn calcium carbide was placed in four tins containing water and the door and bottom ventilators were sealed. The four tins were spaced evenly throughout the barn so as to obtain an even distribution of the gas. The quantity varied in the different experiments, and details as to quantities are given later. In calculating the quantity used it was taken that 500 grms. of calcium carbide would give 175 litres of C_2H_2 gas.

At intervals the barns were ventilated so as to allow CO_2 to disperse.

The number of applications and intervals between varied in the experiments and details are given below.

Experiment I

In this experiment the leaf was principally from second harvesting or picking, though there was a small quantity of first harvesting from some plants. The leaf was divided in the manner previously described between the control and the

experimental barns. The control barn was cured in the normal manner, fire being started immediately the barn was closed and the temperature raised 5° F. above the atmospheric temperature.

The temperatures of each barn on being closed were the same, viz. Dry Bulb 71° F., Wet Bulb 70°F. In the experimental barn 44 grms. of calcium carbide was equally divided between four tins of water prior to the barn being closed and, at the same time, fires were started in the control barn.

After 18 hours both barns were aired to allow CO_2 to disperse. It was then observed that yellowing had commenced in both barns; in the control barn the leaf had definitely wilted, whereas in the experimental there was no signs of wilting. Before closing the experimental barn a further application of calcium carbide, at the same rate, was applied.

After 42 hours the experimental barn was aired and slight ventilation was placed on the control barn. It was now observed that the yellowing process was more advanced and more even in the experimental barn than in the control barn. The yellowing in the top of the experimental barn was more advanced than the bottom. The greatest difference between the barns was observed in the condition of the leaf. In the control barn the leaf had wilted and was limp, whilst in the experimental barn the leaf appeared as fresh and rigid as when placed in the barn. After airing the experimental barn, fire was commenced and curing carried out in the normal manner.

After 66 hours it was observed that the colour of the leaf in the experimental barn was far superior to that in the control barn. The leaf in both barns was drying.

General Remarks.—The weather conditions experienced throughout the experiment were dry sunny days with a fairly high wind.

The most outstanding features to be observed during the experiment were: Firstly, the difference in the appearance of the leaf in the experimental and control barn; in the experimental barn the leaf retained its fresh appearance and rigidity, and no signs of wilting were observable after 72 hours, whereas in the control barn the leaf was showing definite signs of wilting after 24 hours. Secondly, the leaf in the experimental

barn yellowed more evenly than in the control barn, and the final product was far superior in colour and texture.

Experiment No. 2

This experiment was commenced on July 13, 1938. The weather conditions were cloudy and rain threatening with a higher atmospheric humidity than at the commencement of the first experiment.

The leaf was the third harvesting from the same varieties and fields as for the previous experiment, and the barns were filled in the same manner. In order that the wilting of the leaf in the control barn should not be hastened by increased temperatures fires were not commenced until this was done in the experimental barn.

Calcium carbide was placed in the experimental barn as before, though the quantity was doubled, viz. 88 grms. The temperatures on closing the barns were the same, viz. Dry Bulb, 72° F.; Wet Bulb, 71° F.

Both barns were opened and ventilated to allow CO_2 to disperse 18 hours later, and at this stage there were no observable differences to be recorded between the barns. A further application of calcium carbide was made in the experimental barn and the barns closed once more.

The barns were again ventilated 42 hours after the commencement of the experiment to allow CO_2 to disperse, and marked differences were then observable. In the control barn the leaf had commenced yellowing but unevenly; it had also wilted considerably, and the leaf was limp, whereas, in the experimental barn, the leaf had retained its fresh appearance, and the yellowing was more advanced and more even. Fires were then started and curing carried out in the normal manner, and the yellowing in the experimental barn was much quicker than in the control, and more even throughout the barn. No difference in the length of time required to cure the barns was recorded; the experimental barn seemed to require a longer period to dry out the leaf than the control barn.

General Remarks.—Here again the effect of the gas on the yellowing process and the wilting of the leaf was most pronounced, though the increased application did not appear to have any greater effect. The cured leaf from the experimental

barn was much superior in colour and texture, and the elasticity appeared to be better.

Experiment No 3

This experiment was commenced on July 25, 1938. The weather conditions were dry and sunny with a lower atmospheric humidity than at the commencement of the previous experiment.

In this experiment the leaf was from the same varieties and fields as before, and it was divided into heavy and light leaf. The heavy leaf which normally takes longer to cure and often remains green when cured with bright leaf, was placed in the experimental barn and the light leaf in the control barn.

On closing the barns at 6 p.m. the temperatures were the same in both, viz. Dry Bulb, 70° F.; Wet Bulb, 68° F. In the experimental barn 88 grms. of calcium carbide was used as in the previous experiment. Fires were started in the control barn 15 hours later, and 22 hours after the commencement of the experiment the leaf in the control barn was showing signs of yellowing.

The experimental barn was opened 22 hours after the commencement of the experiment to allow CO_2 to disperse, and the leaf was showing signs of yellowing. A further application of calcium carbide was made and the barn closed.

Forty-six hours after the commencement of the experiment the experimental barn was ventilated to allow CO_2 to disperse, and fire started. At this stage it was observed that the yellowing was more advanced than the control, and more even, and the leaf still retained its fresh appearance.

Seventy hours after the commencement of the experiment the yellowing process in the experimental barn was completed, whereas in the control the yellowing was still proceeding slowly.

General Remarks.—Despite the heavy leaf all the varieties in the experimental barn yellowed quicker and more evenly than in the control, and the leaf retained its freshness for a longer period.

Experiment No. 4

This experiment was commenced on August 26, 1938, and leaf, which was top leaf of the same varieties, was distributed between the two barns as in the first two experiments. The temperature of the two barns on being closed was the same, viz. Dry Bulb, 72° F.; Wet Bulb, 70° F. In the experimental barn 44 grms. of calcium carbide were placed before closing.

After 18 hours both barns were ventilated for 10 mins. to allow CO_2 to disperse, and before closing a further application of calcium carbide made in the experimental barn. Yellowing had commenced in both barns, but more definite signs were observed in the experimental barn.

After 42 hours both barns were again ventilated, and it was observed that the leaf in the experimental barn was much more advanced than in the control and, whilst the leaf in the control barn was wilted, that in the experimental barn still retained its fresh appearance. Fires were commenced in both barns and the curing continued in the normal manner. There was no difference to be recorded in the time of curing for both barns.

General Remarks.—Again the most outstanding feature was the observed difference between the condition of the leaf in the two barns, that in the experimental barn retaining its freshness and rigidity for a far greater period than in the control barn, and the yellowing, also, was much quicker and more even.

Summary of grades obtained and average price

After curing, the leaf was graded at the Government Tobacco Warehouse, and subsequently sold. The grades obtained are summarised below and the average price per kilo obtained in respect of each experiment inserted, and which might be considered as a grade index. It will be observed that in each experiment the average price is higher for the leaf cured with the aid of acetylene gas.

GRADE OF LEAF OBTAINED AND AVERAGE PRICE

Experiment No.	Brights.		Mediums.		Darks.		Green.		Scrap.		Total Weight *Kilos.*	Average price per kilo. *R. : cents.*
	Weight *Kilos.*	*Per cent.*	Weight *Kilos.*	*Per cent.*	Weight *Kilos.*	*Per cent.*	Weight *Kilos.*	*Per cent.*	Weight *Kilos.*	*Per cent.*		
Experimental Barns												
1 . . .	22·7	67·3	7·0	20·7	0·2	0·6	1·6	4·8	2·2	6·6	33·7	1 : 31·4
2 . . .	40·8	63·1	17·6	27·2	1·3	2·0	2·0	3·0	3·0	4·7	64·7	1 : 35·47
3 . . .	21·8	28·1	32·2	41·4	20·2	26·1	1·3	1·7	2·1	2·7	77·6	1 : 10·2
4 . . .	14·6	25·3	24·2	42·1	15·7	27·2	1·7	3·0	1·4	2·4	57·6	1 : 08·82
	99·9	42·6	81·0	34·7	37·4	16·2	6·6	2·8	8·7	3·7	233·6	1 : 19·9
Control Barns												
1 . . .	15·9	45·3	13·7	39·0	1·5	4·3	2·6	7·4	1·4	4·0	35·1	1 : 12·68
2 . . .	27·2	46·0	25·0	42·3	1·4	2·4	1·5	2·5	4·0	6·8	59·1	1 : 18·46
3 . . .	8·8	11·7	47·9	63·7	15·3	20·3	1·1	1·5	2·1	2·8	75·2	– : 96·73
4 . . .	5·1	8·1	26·1	41·6	29·7	47·2	1·1	1·8	0·8	1·3	62·8	– : 97·64
	57·0	24·6	112·7	48·6	47·9	20·6	6·3	2·7	8·3	3·5	232·2	1 : 05·35

From the above figures it will be seen that the greatest difference is to be found in the distribution between the bright, medium, and dark grades, with the experimental barns showing the better distribution. The fact that seven different varieties were being cured in the barns at the same time must be kept in view as this undoubtedly has a great effect on the final results, and was largely responsible for the high percentage of darks, it being well known that the time required for the yellowing stage of curing in different varieties varies considerably. The most striking feature in the above figures is the difference in the percentage of brights obtained, which would appear to indicate that under the gas treatment the yellowing process is much more even, and supports the observations recorded during curing.

It is naturally expected that when the percentage of bright leaf is higher the average price obtained is higher, and such is found to be the case. In each experiment the leaf cured under the gas treatment obtained the higher price, the difference varying between 11 to 17 cents per kilo, or approximately *2d.* to *3d.* per kilo, with a difference of 14 cents between the average prices for the total.

Smoking Tests

Samples of leaf were extracted and smoking tests carried out. The results of these tests are summarised below:

Variety.	Control.	Experimental.
Gold Leaf . .	Slight tang, mild, hot.	Very slight tang, mild cool and rather sweet.
Yellow Mammoth	Very slight tang, mild, rather sweet.	Very slight, if any, tang, rather hot, pleasant.
White Mammoth	Slight earthy tang, hot and rather strong.	Slight tang, mild, hot and sweet.
Jamaica Wrapper	Slight earthy tang, rather unpleasant.	Very slight tang, mild, rather hot.
Virginia Bright .	Slight tang, mild.	Very slight tang, mild and hot.
Bonanza . .	Slight trace of tang, mild, hot.	No tang, neutral flavour, mild, cool.
Cash . . .	Slight earthy tang, mild.	No tang, neutral flavour, rather sweet, cool.

All the samples burnt freely.

From the tests carried out it would seem that the gas has a beneficial effect on the flavour, which is in accordance with the results achieved by Drs. Pfüster and Losch and by Dr. U.

Rossi, whose work has already been referred to. The recorded difference, however, is not very pronounced, and this question will receive further consideration during the coming season.

General Conclusions

Though it is premature to draw definite conclusions on certain aspects of these experiments it is possible to state definitely that an application of acetylene gas, C_2H_2, at a rate of 1 : 5,000 does assist in the curing of leaf by (*a*) hastening the yellowing period, which also proceeds more evenly throughout the barn, and (*b*) decreasing the rate of drying of the leaf, thereby reducing the risk of the leaf retaining its green colour. This latter property is of great assistance when curing leaf during a period of low atmospheric humidity accompanied by high winds so often experienced in this country.

Recommendations

I have no hesitation in recommending growers to try this method, as by the use of the gas better results should be achieved and, even though the gas may not have any pronounced beneficial effects on flavour, it certainly has no detrimental effects, whilst the effect on the yellowing of the leaf and the drying process is of great assistance.

The cost is very small, being but 30 to 40 cents per barn, allowing for two applications, the second application 18 hours after the first.

The writer will be pleased to assist any grower who is desirous of testing this method, and will be glad to have the results of any experiments which may be carried out.

II. Report on Tobacco from Mauritius

The samples which form the subject of this report were forwarded to the Imperial Institute by the Director of Agriculture, Mauritius, in February 1939.

They represented seven different varieties of leaf tobacco cured with acetylene gas, and the same varieties cured by normal methods. It was desired to ascertain whether any improvement in the qualities of the tobacco had been effected by the treatment.

The samples were as follows:

No.	Label.	Weight.	
1	Virginia Bright	1 lb.	Gas treated
2	Cash	13 oz.	,,
3	Yellow Mammoth	1 lb.	,,
4	Gold Leaf	14½ oz.	,,
5	Jamaica Wrapper	10½ oz.	,,
6	Bonanza	1 lb.	,,
7	White Mammoth	13½ oz.	,,
8	Virginia Bright	1 lb.	Untreated
9	Cash	14 oz.	,,
10	Yellow Mammoth	12½ oz.	,,
11	Gold Leaf	1 lb. 1½ oz.	,,
12	Jamaica Wrapper	12 oz.	,,
13	Bonanza	1 lb. 1 oz.	,,
14	White Mammoth	1 lb. 1 oz.	,,

Description

No. 1. *Virginia Bright. Gas treated.—Colour mainly bright, leaves thin, but of fair strength, from* 15 *in.* × 5 *in. to* 17 *in.* × 6½ *in. Midribs fair.*

No. 8. *Virginia Bright. Untreated.—Colour generally from bright to semi-bright, but some darker leaves present, leaves not quite so strong as No.* 1, *from* 13 *in.* × 4½ *in. to* 15½ *in.* ×6 *in. Midribs similar to No.* 1.

No. 2. *Cash. Gas treated.—Colour semi-bright to dark, fairly thin but of fair strength, from* 13½ *in.* ×4 *in. to* 19 *in.* ×6½ *in. Midribs fair.*

No. 9. *Cash. Untreated.—Colour somewhat dark, some leaves showing greenness, leaves of fair strength, from* 13 *in* ×4½ *in. to* 19 *in.* × 6 *in. Midribs fair.*

No. 3. *Yellow Mammoth. Gas treated.—Colour semi-bright, but somewhat uneven, leaves rather broken, thin, but of fair strength, from* 13 *in.* × 6 *in. to* 14 *in.* × 7 *in. Midribs fair.*

No. 10. *Yellow Mammoth. Untreated.—Colour mainly semi-bright, on the whole, darker than No.* 3, *leaves of weak to fair strength, some rather thin leaves present, from* 15 *in.* × 5 *in. to* 16 *in.* × 7 *in. Midribs fair.*

No. 4.—*Gold Leaf. Gas treated.—Colour mainly bright, leaves of fair strength and moderate substance, from* 13½ *in.* × 6 *in. to* 14½ *in.* × 7 *in. Midribs fair.*

No. 11. *Gold Leaf. Untreated.—Colour considerably darker than No.* 4, *leaves of fair strength, from* 12½ *in.* × 4 *in. to* 15 *in.* × 6 *in. Midribs similar to No.* 4.

No. 5.—*Jamaica Wrapper. Gas treated.—Colour mainly bright, but many of the leaves badly broken, thin generally but of fair strength, from* 11 *in.* × 5 *in. to* 13½ *in.* × 7 *in. Midribs fair.*

No. 12. *Jamaica Wrapper. Untreated.—Colour darker than No.* 5, *but sample in better condition* (*i.e. leaves not so broken*), *a few leaves however showed greenness, leaves generally strong and of good texture, from* 13½ *in.* × 4½ *in. to* 17½ *in.* × 6½ *in. Midribs a trifle heavy.*

No. 6.—*Bonanza. Gas treated.—Colour mainly bright, leaves somewhat thin but of fair strength, from* 14 *in.* × 5 *in. to* 15 *in.* × 7 *in. Midribs a trifle heavy.*

No. 13. *Bonanza. Untreated.—Bright colour, leaves of fair texture and strength, but some of the leaves were rather badly broken, from* 13 *in.* × 4½ *in. to* 15 *in.* × 5½ *in. Midribs similar to No.* 6.

No. 7.—*White Mammoth. Gas treated.—Colour mainly bright, many leaves in broken condition, thin but of fair strength, from* 13 *in.* × 5 *in. to* 15 *in.* × 7 *in. Midribs a trifle heavy.*

No. 14.—*White Mammoth. Untreated.—Colour somewhat darker than the above, leaves in better condition* (*i.e. not so broken*), *of fair substance, strength and midribs similar to No.* 7, *from* 15 *in.* × 5 *in. to* 17½ *in.* × 7 *in.*

Results of Examination

The following four samples, after removal of midribs, were chemically examined, and the results given below are calculated for material containing 14 per cent. of moisture:

	No. 1	No. 8	No. 5	No. 12
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*
Nicotine .	1·50	1·40	1·40	1·46
Nitrogen .	1·28	1·68	1·64	1·55
Ash . .	10·6	10·5	14·7	12·2

The results show that the chemical composition of the leaves treated in the curing stage with acetylene does not differ appreciably from that of the leaves of the corresponding untreated tobacco.

As regards the nicotine and nitrogen contents, the nicotine in the gas treated sample No. 1 shows a very slight increase over that in the corresponding untreated sample No. 8, but

in the case of Nos. 5 and 12 it is the untreated sample which contains the slightly higher amount of nicotine.

Regarding the amounts of nitrogen in the four samples, No. 1 shows a decrease in this constituent compared with the corresponding untreated sample No. 8, but, on the other hand, sample No. 5 shows a slight increase in the amount of nitrogen compared with the corresponding untreated sample No. 12.

Smoking trials were carried out on the whole of the fourteen samples. The tobacco used for this purpose was deprived of the midrib, and the lamina was then cut up, and smoked in the form of cigarettes. The results showed that the difference in the smoking qualities of the "gas treated" and untreated samples was negligible, and also that the treatment of the leaf with acetylene had not improved the aroma and flavour of the tobacco.

A duplicate set of the fourteen samples was submitted to a firm of tobacco leaf merchants in London, who submitted the following report to the Government Tobacco Officer, Mauritius.

Mauritius Tobacco

Parcel No. 1. Gas treated

No. 1. Virginia Bright. A mild smoke with a fair Rhodesian type flavour, but slightly better and slightly hot. Cuts a bright golden colour.

No. 2. Cash.—A mild smoke with a slight Rhodesian type flavour, but slightly hot. Cuts British orange colour.

No. 3.—Yellow Mammoth.—A mild smoke with a good Rhodesian type flavour, but is slightly bitter and slightly hot. Cuts good golden colour.

No. 4. Gold Leaf.—A very mild smoke, slightly bitter, but has a fair Rhodesian type flavour. Smokes fairly cool. Cuts a good lemon colour.

No. 5. Jamaica Wrapper.—A mild smoke with no flavour, but slightly sweet and cool. Cuts golden orange colour.

No. 6. Bonanza.—A very mild smoke with a rather unpleasant flavour and smokes slightly bitter and slightly hot. Cuts a bright golden colour. Taking it as a whole a poor smoke.

No. 7. White Mammoth.—A very mild smoke with a fair Rhodesian type flavour. Is slightly sweet but smokes slightly hot. Cuts light golden colour.

Mauritius Tobacco

Parcel No. 2. Not Gas treated

No. 8. Virginia Bright.—A mild smoke with a fair Rhodesian type flavour. Slightly sweet and smokes cool. Cuts an orange colour.

No. 9. Cash.—A mild smoke with a fair Rhodesian type flavour, but is slightly bitter and smokes a little hot. Cuts dark orange. Rather a poor smoke.

No. 10.—Yellow Mammoth.—A mild smoke with a fair Rhodesian type flavour. Slightly sweet—cool. Cuts bright orange.

No. 11. Gold Leaf.—A mild smoke with a poor flavour. Slightly bitter and smokes a little hot. Cuts a golden colour. A poor smoke.

No. 12. Jamaica Wrapper.—A mild smoke with a slightly unpleasant flavour but is cool. Cuts a golden colour. Not a pleasant smoke.

No. 13. Bonanza.—A mild smoke with a fair Rhodesian type flavour and smokes fairly cool. Cuts a good lemon colour.

No. 14. White Mammoth.—A very mild smoke with a rather insipid flavour. Slightly bitter and smokes a little hot. Cuts golden orange colour.

The firm added that the tobaccos were all lacking in character and were very mild.

Conclusions

The results of the examination of these tobaccos carried out at the Imperial Institute confirm the opinion of the tobacco merchants consulted that no definite improvement could be detected in either the aroma or flavour of the tobaccos, as the result of having been subjected to treatment with acetylene gas.

The treatment, however, has resulted in an improvement in the colour of the leaves, which is brighter than the untreated samples, and more even throughout, the leaf generally being more pleasing in appearance.

In forwarding this report to the Director of Agriculture, it was suggested that it would perhaps be worth while trying experiments in Mauritius with ethylene, or, failing that, with acetylene at higher concentrations than those used in the present experiments.

ARTICLE

THE APPLICATION OF ECONOMIC BOTANY IN THE TROPICS [1]

By Sir Frank Stockdale, K.C.M.G., C.B.E., F.L.S.
Agricultural Adviser to the Secretary of State for the Colonies.

Many of the economic crop plants which are commonly grown at the present time throughout the tropics owe their distribution to transfers consequent upon the discoveries of new lands in the Elizabethan era. Tobacco, for example, as is well known, was obtained from tropical America, whilst the sugar-cane and the banana are of old-world origin ; cacao came from Central and South America, and rubber from Brazil. The many species of coffee are indigenous to tropical Africa, and the original home of the citrus group appears to be China and Cochin China.

Distribution in the early days was haphazard, but later organised expeditions were made for the collection of specific plant material for trial in other parts of the world. The Royal Gardens at Kew played an important part in these earlier expeditions, and reference need only be made to the results which followed the work of Markham and Ledger in regard to cinchona, and of Wickham in respect of the establishment of the plantation rubber industry in the East.

Botanic Gardens established by Governments in many parts of the Indian and Colonial possessions played their role in the trial of these introductions, but in other cases important industries in the tropics have resulted from unofficial enterprise. The Arabian coffee in East Africa is mainly derived from French mission strains, whilst the establishment of cacao in West Africa, oil palms in the East, and sisal in East Africa, is the consequence largely of individual enterprise and experiment.

Vast areas of the tropics were opened up during the last century in economic crops, mainly from seed derived from the earlier introductions. The earlier work was confined largely to tests of acclimatisation under varying conditions of

[1] Paper prepared, with lantern slides, for the British Association Meeting Dundee, 1939.

soil and environment. The tropical crops presented a mixture of varietal types, and those types which were best adapted to the soil and climatic conditions survived. More often than not the adaptation of several types was sufficiently close, and a mixture of types formed the crop. It was only where vegetative propagation was the normal cultural practice, as in the case of the sugar-cane or the banana, that selections of planting material true to type were practised by the growers.

Scientific interest in tropical crop plants was first aroused by the outbreak of coffee leaf disease in Ceylon, and the investigations of that disease by Marshall-Ward are classic of the period. All attempts, however, to save the industry were in vain, and Ceylon was compelled to replace its coffee cultivations by those of cinchona for a period and later by tea in the hills and rubber in the low country.

Subsequently, disaster befell the West Indian sugar industry as the varieties then under cultivation succumbed to disease. New types of sugar-cane were introduced, and the breeding of a series of seedlings from different varieties of *Saccharum officinarum*—or noble canes—was begun by Harrison and Bovell. With the disease-resisting seedlings thus raised the industry was again rebuilt and, indeed, considerably improved. Barber, who had worked in the West Indies, was transferred to India, and the work for the sugar industry of that country was started by him at Coimbatore, where research work has developed from his beginnings under Venkatraman. The Dutch workers were also engaged in sugar-cane breeding work in the Netherlands Indies in order to obtain types resistant to the sereh disease, and they proceeded to develop the early technique for controlled breeding and established that different varieties possessed varying percentages of viable pollen. Kobus visited India in 1890 and took back with him certain types of thin canes which proved to be highly resistant to sereh. The results were encouraging and have led to the extended use of interspecific crossing. Barber was in fact the first to recognise the close affinity of *Saccharum spontaneum* with the canes of Northern India and to introduce that wild species into the parentage of cross-bred canes. The "ennobling" of *Saccharum spontaneum*, as the result of Jeswiet's conclusions, based upon morphological studies regarding the origin of the Kassoer cane, was taken up seriously in Java, and many

valuable forms, notably the well-known P.O.J.2878, resulted from a third "nobilisation" of *Saccharum spontaneum* (Plate IX, fig. 1). Similar attempts have been made to utilise other wild species of *Saccharum* and it has been established that there are numerous strains of *Saccharum spontaneum*, collections of which have been recently made from various countries.

Noble canes give high tonnage when grown in soils of reasonably good fertility, and possess good milling and chemical properties. They are, however, unsuited to infertile and badly-cultivated soils and are susceptible to mosaic disease. Seedlings resulting from the nobilisation of wild species have been found to possess hybrid vigour to a high degree, and by this means also varieties suited to poorer soils and conditions less favourable to the growth of the sugar-cane have been evolved. In the British Empire, research work on improvement of the sugar-cane is now carried out at Coimbatore in India, the Central West Indian Cane Breeding Station at Barbados, and at the Research Stations in Mauritius and British Guiana.

No crop has received more scientific attention than cotton. The number of varieties is considerable, and their classification is a matter of difficulty. Wild types occur in both Asia and America and also in Australia and Polynesia, whilst the cultivated cottons fall into two definite groups—the old and the new world cottons. The numerous varieties which are now cultivated are the products of selection. Growers themselves have played an important part in this work, but during the past thirty years scientific workers in Egypt, the Sudan, India, the United States and in various parts of the Colonial Empire have been responsible for marked advances. Reference need only be made here to the valuable work done by Balls, Bailey, Parnell, Harland and Mason.

The work in the British Empire has been greatly assisted by the scientific officers of the Empire Cotton Growing Corporation. Selections for yield, improved lint length, fineness and strength of lint, and ginning out-turn, have all received attention, whilst much research into the general physiology of the plant and into the genetic constitution of the various forms has been carried out.

Attention in recent years has been directed to the selection of types resistant to diseases and to insect pests. It is necessary here only to mention the success which has been achieved in

PLATE IX

ECONOMIC BOTANY IN THE TROPICS.

FIG. 1—HYBRID SUGAR-CANE.

FIG. 2 CACAO SELECTION.

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PLATE X

ECONOMIC BOTANY IN THE TROPICS.

FIG. 1 RUBBER CLONES IN MALAYA.

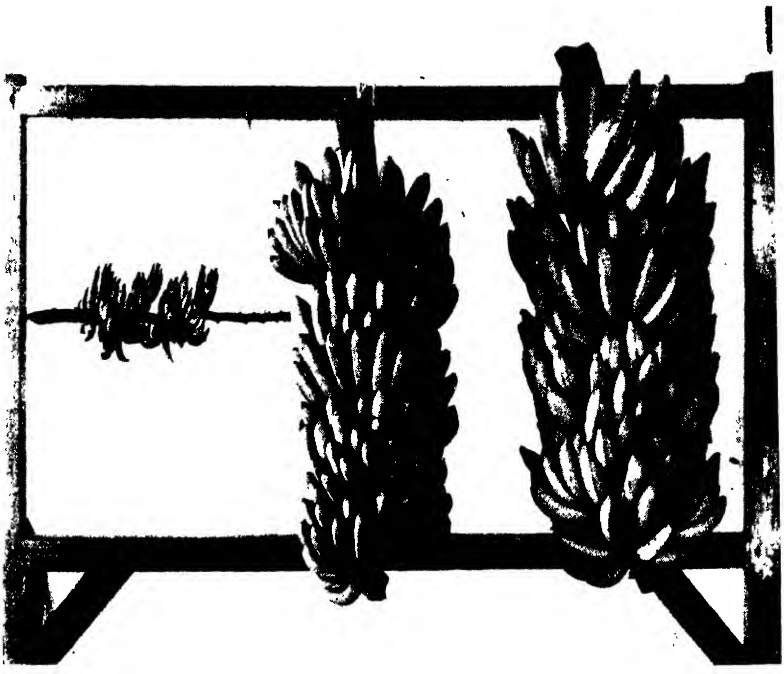

FIG. 2 HYBRID BANANA.

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the United States in the production of strains resistant to cotton wilt, the isolation of types by Parnell immune to Jassid attack, and the development in the Sudan of forms resistant to leaf curl. The nature of the resistance has in every case been the subject of investigation, and not infrequently it has been found that this characteristic is the result of factors which enable the plant to establish a state of equilibrium with its environment.

In permanent or orchard crops the earliest important work was carried out by Dutch workers with cinchona. The introduction of *C. ledgeriana*, with its high quinine content, and its proved suitability to certain soil and climatic conditions in the Dutch East Indies led to the displacement of *C. succirubra* cultivations both in Java and other countries, whilst careful and extended selection based upon bark analyses over the past forty years has led to the establishment of greatly improved strains. This work with cinchona produced remarkable results, and led to other research workers in the Dutch East Indies making an examination of the rubber cultivations which had been established from seeds collected by Wickham in the Amazon and distributed by Kew to India, Ceylon and the Straits Settlements.

This examination of the populations in rubber cultivations in Java showed that there was great variability in yielding capacity. In certain instances it was found that 25 per cent. of the trees were producing 75 per cent. of the crop. Isolation of high-yielding mother trees followed, and similar work was started in both Malaya and Ceylon. These selected mother trees were then propagated by a system known in the East as bud-grafting, and clones thus established were submitted to thorough test (Plate IX, fig. 2). It was found that not every high-yielding mother tree produced satisfactory budded progeny. Several of the clones showed undesirable characteristics, and from a large number of selections only a comparatively small number of trees have been accepted as "proved" mother trees. From these, however, considerable areas of budded rubber have been established in the East, and poor-yielding areas of mixed populations are now being replaced. Budded areas are yielding crops greatly in excess of those formerly obtained from seedling planting material. It is, however, felt that possibilities in this particular direction

of securing improved planting material have now been fully explored, and plant breeding is being called upon for the production of seedlings under a system of controlled hybridisation. It has, however, been found that varieties which are not of outstanding merit when used for the production of clones of bud grafts may often be possessed of outstanding merits for the breeding of hybrids. The work of testing families of hybrid seedlings is now proceeding, and it is yet too early to indicate the results which may be expected.

The production of strains resistant to the *Oidium* mildew is an important necessity for certain areas in the East, where this disease is now common, and a search for resistant strains is being commenced.

This work with rubber naturally turned the attention of workers in Trinidad, where the main economic crop is cacao, to the possibility of improvement in the cultivations in that Colony. Early cursory examination of estates established that the cultivations in Trinidad consisted of a mixture of different types and that some of the trees could be isolated as heavy crop producers. Selections from these were made for multiplication. Subsequent and more detailed examinations proved that the bulk of the crop was obtained from a relatively small percentage of the trees in the cultivations, and steps were taken to select from the cacao populations in Trinidad one hundred of the best as mother trees for the future.

Other scientific investigations have also established that in cacao incompatibility exists and that certain strains are sterile to their own pollen (Plate X, fig. 1). This discovery opens up a fresh aspect which has had to be taken into account, as several of the heavy yielders originally selected have proved to be self-incompatible. If this had been ascertained before the selections had been made in Trinidad many of the earlier selected high yielders would not have been included.

The position in cacao in Trinidad, however, became further complicated by the outbreak of witch-broom disease, and it was decided that in addition to the regeneration of cacao estates and the improvement of their yielding capacity with selected Trinidad plant material, it was essential to secure the introduction of disease-resistant strains of commercial value and of wild species of Theobroma resistant to witch-broom disease for plant breeding work.

Expeditions to Ecuador and to the higher reaches of the Amazon were therefore organised, and Dr. Pound, as the result of these arduous missions, has obtained selected plant material of *Theobroma cacao* and several other species which should be of the utmost value to the cacao industry of Trinidad and of the Colonial Empire generally.

Work with cacao is also being proceeded with in the Gold Coast and Nigeria, and in the latter dependency Voelcker is making progress with hybridisations. Some of the Trinidad high-yielding strains are also being sent, after quarantine at the Royal Gardens, Kew, to West Africa for this breeding programme.

Diseases amongst cultivations of Gros Michel bananas in Jamaica and other areas of the West Indies have made it clear that plant breeding work in this crop is likely to play an important role. Panama disease, caused by a soil-inhabiting fungus—*Fusarium cubense*—has resulted in the loss to banana cultivation of 40,000 acres in Jamaica, and considerable damage is now being caused in the West Indies and certain parts of Central America by the leaf spot disease caused by *Cercospora musae*. The genetical study of the genus Musa and breeding work have been proceeding in Trinidad by Cheesman, whilst Larter has also been engaged on a breeding programme in Jamaica. Seedlings resulting from crossings between the Gros Michel variety of edible and seedless bananas and the wild seeded *Musa acuminata* have been raised and tested (Plate X, fig. 2).

It is unnecessary here to deal with the results obtained by Cheesman in his genetical studies, but it has become obvious that although different strains of *Musa acuminata* occur it is necessary to widen the interspecific crossings. Large numbers of new wild forms of Musa have recently been obtained from seed collected in Malaya, Assam and New Guinea, and a special expedition to Northern Siam and Indo-China is under contemplation.

Nor has plant improvement work been limited to the cash crops of the tropics. Some of the important food crops have received attention, particularly rice—with work being carried out in British Guiana, Ceylon, Malaya, and Sierra Leone.

Pure line selection work has been the basis of the improvements effected, and in certain instances very satisfactory

results have been obtained. The exchange of rice varieties from one area to another has not been productive of any marked improvement, although it is anticipated that when selection work has produced its maximum effects in crop improvement, hybridisation will have to be more extensively resorted to and exchanges made from one area to another for this work. In Java, for example, where harvesting of rice has for generations been done by the growers ear by ear, selection work has not been productive of any marked improvements. Most of the cultivations are themselves almost pure, and hybridisation alone is thought to offer chances of material advance (Plate XI, fig. 1).

Other tropical food crops, such as maize, millets, cassava and groundnuts, are receiving attention, particularly in Africa, but more work with these important crops is still required. Progress has been made with maize in Kenya, and efforts are now being made both at Amani and elsewhere in East Africa, as well as in the Gold Coast, to find or evolve cassava types resistant to brown streak and mosaic diseases (Plate XI, fig. 2). It may also be recorded that all the wheat now being grown in Kenya is of varieties which have been bred by Burton in co-operation with Plant Pathologists. It has been necessary to evolve types resistant to a number of physiological forms of rusts, and this has been successfully achieved.

Other important work of crop improvement is being done at the East African Agricultural Research Station at Amani with sisal.

In regard to coffee, work is proceeding in Kenya and Tanganyika. Nutman's studies of the rooting systems and the effect of light on the stomatal mechanism in *Coffea arabica* at Amani and elsewhere in East Africa have been outstanding. They have made clear the causes of die-back consequent upon the utilisation of the carbohydrate reserves by the growing crop, and made possible a better understanding of the problem of shade (Plate XII, fig. 1). If this latter knowledge relating to the use of shade in adjusting the coffee plant to its environment had been available to Marshall-Ward when he investigated the leaf disease of coffee in Ceylon, it is permitted to us to speculate whether the coffee industry in that Colony might not have been saved. It certainly explains how it is that *Coffea arabica* still persists in patches in certain villages in

PLATE XI

Economic Botany in the Tropics.

Fig. 1 Rice Selection in Malaya.

Fig. 2—Mosaic in Cassava.

PLATE XII

ECONOMIC BOTANY IN THE TROPICS.

FIG. 1 EXPERIMENTAL SHADING OF COFFEE IN KENYA.

FIG. 2 GIANT STAR GRASS.

facing page 553]

that Colony under fairly heavy shade and produces reasonably good crops.

Carbohydrate exhaustion is also the cause of the die-back of coffee on the Kenya slopes of Mount Elgon, and it is now clear why coffee thrives well on the Uganda side of that mountain and has to struggle for its existence on the Kenya slopes.

Another form of die-back which has been causing some anxiety is that which is occurring in cacao in certain areas of the Gold Coast, where climatic and environmental changes have resulted from the destruction of too great a percentage of the forest belt. Cacao, unless it forms a good canopy or has some forest cover to maintain high atmospheric humidity and uniform soil moisture-content, does not thrive. In these die-back areas of the Gold Coast the reproduction of suitable environmental conditions is now to be attempted.

The ecologists are rendering service in the development of a more satisfactory system of land utilisation, and the work of Trapnell and Staples is outstanding in this respect. The use of vegetation in soil conservation work—so important in many of the arid or semi-arid parts of Africa when soil erosion is seriously progressing—is also now appreciated, and in this connection grasses such as elephant grass (*Pennisetum purpureum*) for use in contour hedges or strips and many of the giant star grasses (*Cynodon* spp.) for giving a good ground cover, are playing an important part (Plate XII, fig. 2). Grazing problems have only comparatively recently been studied by Staples in Tanganyika and by Edwards in Kenya, and an extension of botanical work in connection with pasture and soil erosion problems is clearly indicated.

The above review is but a brief sketch of the very considerable amount of work which is being carried on throughout the tropical Empire in the realm of economic botany.

From the earlier work of plant introduction from one country to another through Botanic Gardens and other agencies, developments have progressively advanced in the direction of selection and breeding work to overcome the ravages of disease and to obtain improvements of crop yields. In a relatively primitive agricultural field the economic botanist has found ample scope to effect advances, but year by year the work becomes more highly specialised, and it is becoming more

fully realised that plant improvement is a relative term which can be interpreted only in terms of environment. Diseases have in the past been overcome, but there are a number which are still causing serious losses. It is necessary here only to refer to the witch-broom disease of cacao in Trinidad, Panama disease of bananas, and the Cercospora leaf-spot disease of bananas which is now causing much concern in Jamaica and elsewhere in the West Indian area. The breeding of resistant forms is the most effective method by which to overcome the difficulties facing producers and co-operative work by plant breeders and pathologists is required if a satisfactory solution of the present-day problems is to be found.

Improved types of crop plants, however, demand higher standards of agriculture, and whilst it is to be expected that improvements may be achieved from further collections of wild forms for special breeding work and from the interchange of strains which have already been evolved, sound developments are likely only to be secured by a general advance in methods of husbandry designed to ensure soil conservation and the maintenance of its fertility, and by the adoption of those agricultural systems which are suited to the particular environment. In this field much work still remains to be done, and additional teams of research workers with specialised training are required in the approach to the problems which are presented to those responsible for the welfare of the peoples of the Colonial Empire.

Description of Illustrations

Plate IX, Fig. 1—Hybrid Sugar-cane. *Saccharum spontaneum* × *S. officinarum*. This is the renowned P.O.J. 2878 raised by Dr. Jeswiet at Passoeroean in Java and is an example of the third degree "nobilisation" from the Java form (glajah) of *S. spontaneum*.

Plate IX, Fig. 2—Cacao Selection. I.C.S. 5. This tree had been self-pollinated 380 times without a single fruit being set. After pollination with pollen from I.C.S. 1 it set 20 pods from the 29 flowers pollinated.

Plate X, Fig. 1—Rubber Clones in Malaya. A view of two areas of the same age—five years from budding—showing a contrast in clone habit of growth between Tj. 1 on the left and G. 1 on the right.

Plate X, Fig. 2—Hybrid Banana. This picture shows a bunch of the fruit of the Gros Michel variety on the right and of *Musa acuminata* on the left. The fruit of the hybrid I.C.2 is shown in the centre.

Plate XI, Fig. 1—Rice Selection in Malaya. Ear to row selection is done at the Central Breeding Stations in Malaya and the resulting seedlings are submitted to critical examination and selection. Pure

lines of selection are maintained by bagging selected plants each year and Latin square variety trials are provided for. Selected strains are sent to Test Stations scattered throughout the rice-growing areas.

Plate XI, Fig. 2—Mosaic in Cassava. This shows two varieties of cassava planted on the same day. The one on the left, M. 20, is highly resistant to mosaic and brown streak, whilst that on the right is heavily infected and stunted with mosaic.

Plate XII, Fig. 1—Experimental Shading of Coffee in Kenya. Field trials are carried out in Kenya to test the effect of shade on Arabica coffee. This photograph shows the regulated artificial shade used for experimental purposes.

Plate XII, Fig. 2—Giant Star Grass. This grass (*Cynodon* sp.) was collected by Dr. Pole-Evans at Kakamega in Kenya. The picture shows one plant on trial in the Union of South Africa which covered an area of 1,200 sq. ft. of ground in 2½ months.

NOTES

The Colonies at the New York World's Fair.—One of the features of the British Pavilion at the World's Fair, which closed on October 31, 1939, was the Colonial Hall, set aside for a general exhibit of the Colonies, their peoples and their products. The main part of this exhibit, which was planned and organised by the Colonial Empire Marketing Board, was in six sections arranged according to a geographical grouping of the Colonies. Each section occupied a bay in the hall, with pictures shown in stillograph machines, and a central diorama depicting typical scenes in the countries concerned. Above, there were arranged round the walls decorative maps, panels, and a set of Colonial crests, which attracted much attention. At the head of the hall a set of five photo-murals illustrated the social service work that is going on in the Colonial Empire, and called attention to the part which American generosity is playing in this valuable work. A collection of postage stamps of the Colonies displayed in the centre of the hall was also very well received by the public.

Information regarding the countries of origin and trade in colonial products was given by a press-button informagraph machine, another similar machine giving particulars as to the climate, communications, etc., in the different Colonies. Further details could be obtained from the inquiry bureau, where a staff of three was on duty. These were Mr. A. J. Findlay, C.M.G., late of the Colonial Agricultural Service, who was in charge of the exhibit, Mr. A. Roose, late of the Malayan Civil Service, and Dr. M. Ashby, of the Plant and Animal Products Department of the Imperial Institute. In questions relating to the British West Indies the staff had the welcome assistance of Mr. C. E. Green, of the Trinidad and Tobago

Information Bureau in New York. Sir William McLean, K.B.E., dealt with matters touching the social and medical services in the Colonies in a series of lecture tours through the United States.

In connection with the inquiry work pamphlets and booklets supplied by different Colonies were distributed to visitors, and Imperial Institute postcards of Empire industries were on sale in the hall. The latter proved of special interest to the teaching profession, who visited the Fair in large numbers. The staff also endeavoured to bring to the notice of the public, and in particular the business world, the work of the Imperial Institute and the Colonial Empire Marketing Board in fostering the production and marketing of colonial products. To this end three public lectures were given at the New York Botanical Garden, and a number of visits made to representatives of firms and trade associations. Plans had been made for a series of afternoons when members of different trade associations would be entertained at the Colonial Hall, but unfortunately it was necessary to abandon these when war was declared.

In view of the work of the Imperial Institute in developing tung oil production in British overseas countries, the opportunity was taken of making a study of the American tung oil industry. To gain information on the trade aspects Dr. Ashby saw representatives of the principal New York firms importing the oil, and also received valuable help from the Bureau of Foreign and Domestic Commerce in Washington. Later he was able to visit the chief tung growing areas in the Southern States and had an opportunity of seeing most of the larger plantations and mills. Three days were spent in Gainesville, Florida, visiting the local groves and oil extraction mills and seeing the experimental work carried on at the University. Special thanks are due to Mr. H. W. Bennett, Mr. Rolf K. Buckley, of the Alachua Tung Oil Company, and Mr. R. D. Dickey, of the University, for their assistance during this visit. An opportunity was taken to see the plantations at Lamont in North Western Florida, which are generally admitted to be among the finest in the country, and finally, three days were spent at Bogalusa, Louisiana, where the United States Department of Agriculture tung oil work is centred. Here Dr. G. F. Potter, who is in charge of the station, showed Dr. Ashby the experimental nurseries and bud-grafting work that the Department is undertaking, and went to great trouble to take him to see many of the larger plantations in Louisiana and Mississippi.

Through such generous help as this, which was met with everywhere on the trip, valuable information was gathered on the problems confronting the tung oil producer, and a detailed report on the work will be published in due course.

Preparation of Tomato Juice.—Tomatoes to be used for the preparation of juice should possess high colour, rich flavour, high total acidity, be juicy rather than " mealy " in texture, and of the correct degree of maturity. Over-ripeness results in a juice of poor flavour, and under-ripeness in one of poor colour as well as poor flavour. In the United States the Stone tomato is considered a very good juice variety. Among others the Alameda Trophy, Norton and several strains of the San Jose Canner are used in California for juice production.

The greatest possible care must be taken in washing, sorting and trimming the fruit. Washing is often done first in a " soaker " washer and then in a rotary washer. The tomatoes are then passed to roller inspection tables where unfit portions of the fruit are removed. The green portions of the fruit are cut away, and some manufacturers even remove the core, since it may impart a harsh taste and affect the colour of the final product.

At one time the juice was extracted by passing the raw fruit through a pulper, but it was found that this procedure destroyed practically all the Vitamin C owing to excessive aeration of the juice, and at the same time impaired the flavour of the juice.

To overcome these disadvantages it is now a common practice to heat the fruit in one way or another before expressing the juice, and to use special extractors. Some manufacturers pass the tomatoes through a scalder and heat them thoroughly, while others heat the fruit for only a minute or two in live steam, sufficiently to scald the skin and flesh near the surface. In other cases the tomatoes are crushed and heated to boiling point.

Two types of juice extractors are commonly employed in the United States, which has the largest production of tomato juice.

One type consists of a tapered screw revolving within a cylinder of perforated metal with holes 20/1000 in. in diameter and 625 holes per square inch. The screw applies a pressure which can be varied to attain the degree of extraction desired. It is usually recommended that not more than 60 per cent. of the fruit be recovered as juice; this yield is attained with light pressure. Heavy pressure gives juice of too thick a consistency and of harsh flavour.

In the other type of extractor known as the " Indiana Juice Machine," there is a hopper in which the tomatoes are cut into small pieces by a cutter which revolves slowly. The cut tomatoes then pass to the screen section of the machine where they come into contact with two roughened rollers. These two rollers revolve in opposite directions, and they crush the fruit and force the juice through the screen.

The juice extractor and other metal equipment should be made of metal that does not affect the flavour or colour of the juice; iron and copper particularly must be avoided. Some forms of stainless steel, monel metal, nickel, aluminium and glass-lined steel are recommended.

Salt is frequently added to the extracted juice, the amount usually being 4 lb. to 6 lb. per 100 galls. If added at this stage it should be previously dissolved in a small amount of juice and then stirred in with the bulk of the juice. If added in the dry state there is a tendency for the salt to sink without dissolving. Some producers of tomato juice prefer to add it as small pellets or as a small, measured volume of granular salt to the container during the canning or bottling of the juice.

The juice is finally heated and filled hot into cans or bottles, which are closed and processed at 212° F. Plain cans are generally used although the fresh flavour of the juice is retained to a greater degree in coated cans. In the United States nearly 90 per cent. of the tomato juice manufactured is packed in cans and the remainder in bottles.

The temperature of filling and the time of processing varies with different manufacturers. Some prefer filling at 140° to 150° F., while others consider that 180° F. or over is desirable. The time of the final processing will vary with the initial filling temperature and the size of the can or bottle.

Some manufacturers who aim at a very high quality product interpose a deaeration process between the extraction and the packing of the juice. Various deaerators are in use but the general principle consists in passing the heated juice into a partially exhausted tank, where the air occluded in the juice is removed.

The following is a selection of recent literature dealing with tomato juice:

" Commercial Fruit and Vegetable Products." By W. V. Cruess. 2nd Edition (London: McGraw-Hill Publishing Company, Ltd., 1938, price 36*s*.). Contains a chapter of 40 pages on tomato products, including tomato juice.

" Utilization of Fruit in Commercial Production of Fruit Juices." By M. A. Joslyn and G. L. Marsh. *Circ.* 344 (1937), *Calif. Agric. Exp. Sta.* (Berkeley, California; Agricultural Experiment Station, price not stated.)

" Fruit and Vegetable Juices." By D. K. Tressler. *Fruit Prod. J.*, 1938, **17**, No. 7, 198, 210. (New York, N.Y.: Avi Publishing Co., Inc., 31 Union Square, published monthly, annual subscription $2.50 in the United States.)

" Conservation of Vitamin C in Tomato Juice Production." By N. H. Sanborn. *Fruit Prod. J.*, 1938, **17**, No. 6, 164-165.

Utilisation of Rice Husks.—Many attempts have been made to find a use for the enormous quantities of rice husks which accumulate during the milling process. In Burma, a large proportion of the husks is thrown into the rivers, a practice which tends to silt up the rivers. Some of the husks are used as fuel in the rice-mills, and attempts have been made to convert them into briquettes in conjunction with petroleum by-products ; the calorific value of the husks is sufficiently high to admit of their use for the latter purpose, but difficulty has been experienced in preparing a sufficiently coherent briquette, owing to their resilient nature. The calorific value of three samples of rice husks, as reported in the Fifth Report of the Government Laboratory, Siam, 1928-30, averaged 3619, expressed on the dry material. Furnaces specially designed for burning rice husks are described in *Riz et Riziculture*, 1932, **6,** 131-140, whilst a gas producer for rice husks is described in *Gordian,* 1936, **32,** Nr. 996, *Der Mit-Arbeiter,* pp. 107-108.

Rice husks have been used in the manufacture of feeding stuffs for livestock, but their food value is low, and, moreover, their hard siliceous nature makes them dangerous to animals. If used in feeding stuffs sold in Great Britain their presence must be declared under the Fertilizer and Feedstuffs Act.

The composition of rice husks, based on the examination of 20 samples, according to J. B. Reed and F. W. Liepsner ("The By-Products of Rice Milling," *Bulletin No.* 570, 1917, *United States Department of Agriculture*) is as follows :

	Maximum	Minimum	Average
	Per cent.	*Per cent.*	*Per cent.*
Moisture	9·69	5·00	7·93
Ash	22·03	16·40	19·54
Ash insoluble in 10 per cent. H Cl .	20·98	15·27	18·58
Crude fibre	46·82	36·57	41·29
Protein	4·12	1·75	2·66
Ether extract	1·31	0·51	0·80

G. S. Fraps (*Texas Station Bulletin* 245, 1919) has determined the digestibility coefficients of rice hulls, containing 40 per cent. of fibre, with the following results :

	Coefficients of Digestibility (with sheep)
	Per cent.
Ash	24·49
Crude fibre	0·40
Nitrogen free extract	39·80
Protein	8·89
Ether extract	79·33

Digestibility trials with sheep have also been carried out by F. Honcamp and K. Pfaff (*Landw. Vers.-Stat.*, 1924, **102,** 243-259). A basic ration was used to which various mixtures

of polished rice meal and ground rice husk were added. The digestibility of the mixtures steadily decreased as the proportion of husk increased.

An investigation designed to improve the digestibility and feeding value of grain hulls and similar fibrous material, including rice hulls, by treatment with sodium hydroxide, has been carried out in Massachusetts, by J. G. Archibald (*J. Agric. Res.*, 1924, **27**, 245-265). Treatment with 1·5 per cent. NaOH was found to increase markedly the digestibility in the case of oat hulls and barley hulls, the feeding value of the former being doubled. With rice husks, however, the digestibility, although improved, was not increased sufficiently to be of economic significance.

An account of the feeding value of rice husks, together with reference to their deleterious effect on livestock, is given by MM. Heim de Balsac and E. Letar in *Riz et Riziculture*, 1927, **2**, 211-213.

A pure cellulose, suitable for use as a roughage in various cereal foods, is prepared in Louisiana by digestion with strong alkali, followed by a hydration treatment (*Indust. Engng. Chem.*, 1928, **20**, 310). The analysis of the cellulose after hydration is as follows:

	Average of 5 samples.
	Per cent.
Alpha-cellulose	72·81
Hydrated cellulose	24·28
Copper number	9·01
Ash	0·82

It has been suggested that rice husks might be used in the manufacture of linoleum. In this connection it may be mentioned that an English Patent (No. 26959, December 1, 1911) was granted to the Bremer Linoleum-werke, Delmenhorst, Germany, for the manufacture of linoleum and like materials in which ground cork or wood are wholly or partly replaced by ground or pulverised rice husks.

Furfural can be obtained from rice husks by a process of digestion with water under pressure which forms the subject of English Patent No. 207116, April 4, 1923, granted to F. B. La Forge, C. W. Tooke, G. H. Mains and W. F. Clarke.

Trials made at the Imperial Institute indicated that rice husks alone are not suitable for the manufacture of paper. The pulp made from them might be used in conjunction with pulp made from longer fibre in localities where rice husks are obtainable in quantity at negligible cost, but it would probably not be remunerative to ship them overseas for this purpose. A process for treating rice husks for the production of paper pulp is the subject of United States Patent 1570389 of January 19, 1926 (brief abstract in *Brit. Chem. Abs.*, 1926, B, 269).

It is stated in *Industrial and Engineering Chemistry*, 1927, **19**, 20, that a plant for the manufacture of cellulose for artificial silk from rice hulls was then in operation in Louisiana, and in 1937 a large company was being formed in Japan for the same purpose.

Rice husks have been suggested in Burma as a source of silica for glass production (*Ind. Engin.*, February 22, 1919). The husks were found to yield on combustion about 18 per cent. of ash, consisting of silica in a finely-divided condition, and in a higher state of purity than the local quartz sand. It is stated that the husk could itself be used as fuel for the glass factory, the resulting ash being employed as a constituent of the glass.

The possibilities of utilising rice husks for the manufacture of active carbon have been investigated in Madras (*Bull. No.* 39, 1935, *Agric. Dept., Madras*). After carbonising, the charcoal is treated with caustic soda to remove the silica, and then thoroughly washed in water. The resulting charcoal has the porous structure required of an activated carbon and has been successfully used in the manufacture of jaggery and sugar by the open-pan method.

It is stated that a process has been successfully worked out in the Philippines for producing both decolorizing charcoal and sodium silicate (water glass) from the carbonaceous ash obtained by burning the husks in the local rice mills (*Phil. J. Sci.*, 1939, **70**, 143).

Reference to the destructive distillation of rice husks will be found in the *Giornale di Chemica industriale ed applicati*, 1930, **12**, 75.

Other purposes for which rice husks are used or have been proposed are as a packing material, e.g. for glass bottles, as a filler in concrete, as litter for poultry houses, and as an ingredient of soap and soap powder.

Preservation of Fish in Warm Climates.—The principal methods of preserving fish, other than canning, are refrigeration, salting, smoking and drying. The details of the methods used vary in different countries according to local conditions and requirements.

Refrigeration.—To produce frozen fish which after several months of storage is equal in flavour and food value to freshly caught fish, it is essential that they should be placed in the freezing room as soon as possible after leaving the water. Bruising or damage hastens their deterioration, and they should, therefore, be handled as little as possible. A difficulty in freezing fish in tropical countries is that any very slight increase in temperature causes changes in the flesh which cannot be remedied by freezing. Freezing only keeps the

fish in the same condition as that in which it entered the refrigeration chamber, and it is therefore essential that it should be in prime condition. Unless fish can be delivered to the chamber within three or four hours after landing they should be kept in ice or under refrigeration in the boats.

Before freezing, all fish should be thoroughly freed from dirt and slime in clean, cold, running water. Either fresh water or sea water may be used, but care should be taken that it is pure. Larger fish are usually "gutted" before being frozen, although practice in this respect depends on the market for which they are intended. Gutting of smaller fish is normally impracticable. Fish containing much oil are apt to deteriorate more quickly than other varieties.

For freezing, the fish are commonly placed in pans which are set on the refrigerating pipes until the fish are frozen. They are removed by pouring a little cold water on the outside of the pan, which causes sufficient melting to allow the frozen fish to be removed from the pan. Where it is desired to freeze each fish separately, they may be placed on trays or shelves over the pipes.

In most modern up-to-date plants the fish are quick-frozen in brine, and this method is stated to give a product superior to that obtained by freezing in air.

After freezing the fish are "glazed." Glazing is designed to encase each fish in a protective coating of thin clear ice which prevents the evaporation of water from the flesh of the fish with consequent shriveling, helps to prevent the fish turning white, and prevents the entrance of air which tends to make the fish oils deteriorate. Glazing also provides an ice surface on which moulds and fungi cannot grow.

For glazing the fish are immersed quickly in a trough of clean fresh water at a temperature just above freezing point, in a room in which the temperature is maintained at 20° F. to 25° F. The water covers the fish with a thin film, which freezes instantly into a thin coating of ice as soon as the fish is withdrawn from the water. The fish are immersed three or four times until the coating of ice is considered sufficient, and every part of the fish is covered.

Another method of glazing is by means of a hose with a special spray nozzle, with which a fine stream of water may be sprayed on the frozen fish.

After glazing the fish are taken to the cold-storage rooms, which are kept at temperatures ranging from $-5°$ to $+10°$ F., and kept until required for market.

Salting.—Difficulties in salting fish in warm climates are due chiefly to the slow penetration of salt and the rapid decomposition of the fish. In this connection, in experiments carried out in the Fishery Products Laboratory, United States

Bureau of Fisheries, it was found that calcium and magnesium salts, common impurities found in commercial salt, greatly retard the penetration of the salt into the fish. It was also found that the salt penetrates the fish far more quickly if it is applied as dry salt than if in the form of brine. Of great importance also in the salting of fish in warm climates is the thorough cleaning of the fish before salting, since it was found that while thoroughly cleaned fish could be salted successfully at temperatures of 90° F. to 100° F., fish containing blood, roe and milt spoiled at about 65° F.

Before salt is applied, therefore, the fish should be beheaded, and the entrails, kidneys and roe removed, and the fish thoroughly washed, preferably in cold brine about the strength of sea-water, or in fresh water. The fish should be rolled in the salt, which should be as fine grained as possible, the belly cavities filled, and the fish packed with their backs down, in tubs. A weight should be placed on the fish, sufficient to keep them immersed in the brine formed by the absorption of the water from the fish by the salt, without crushing them. After the fish have become thoroughly saturated with salt, or "struck through," the tubs may be packed full.

Another method of salting which is also used is that of brine salting. In this method the cleaned fish are placed in large vats partially filled with concentrated salt solution. A small amount of salt is put on top of the fish floating in the brine, and the fish are stirred regularly to prevent the brine becoming too dilute at any one point.

The proportion of salt used varies from 10 per cent. to 35 per cent. of the weight of the fish according to the kind of fish, climatic conditions and local customs. The time required for salting depends on the temperature and the size of the fish. Small fish can often be salted in about two days.

For immediate marketing the fish should be taken from the brine and the brine drained off. More dry salt is then applied, and the fish are packed in containers ready for the market. If the fish are to be held for some time, however, it is necessary to keep them under the brine continually to exclude air, which causes the fat in the fish to "rust." For this purpose the barrels should be filled with fish, headed, and nearly filled with brine through the bunghole. In warm climates, however, where possible, salted fish which is not to be consumed for any considerable time should preferably be kept in cold storage.

In connection with the salting of fatty fish, experiments carried out at the United States Bureau of Fisheries Laboratory in 1937 showed that the addition of 30 per cent. of pulverised whole oats, based on the weight of salt used, to the brine in which mackerel were first dipped for salting, considerably

reduced rancidity in the fish after storage. As far as the Imperial Institute is aware, however, this process is not being used at present on any commercial scale for the salting of fatty fish.

Another method of preserving fish, which is closely related to salting, is the preservation by means of sodium hypochlorite, which is a powerful preservative and steriliser, and, in acting on organic matter, is converted into sodium chloride. The Madras Fisheries Department have been making preliminary experiments with this method, but it is not used on any commercial scale at present.

Smoking.—Small fish are usually smoked without evisceration: larger fish are beheaded, eviscerated and often cut into strips or small pieces. In Europe and America fish are generally salted by immersion in brine or by adding dry salt before smoking, the degree of salting depending on the nature of the fish and the type of product desired. In the East, fish are often smoked without any preliminary salting. Before smoking and after immersion in brine the fish should be partially dried in the open air.

Smoking is of two kinds, hot-smoking and cold-smoking. In hot-smoking the fish are kept close to the fire and are wholly or partly cooked in the smoking process, which is completed in a few hours. In cold-smoking the fish are hung some distance from the fire and are smoked at a temperature not exceeding 80° F. The time taken for cold-smoking varies, according to the product required, from a few hours to several weeks, as in the case of hard herring.

The woods chiefly used for smoking are hard woods, the most important considerations in choosing the woods being to use one which burns slowly and produces a large amount of smoke. Soft woods which contain resin should not be used, since the resins are liable to give a disagreeable taste to the fish.

The method of building the fire and the erection of the smokehouse depend considerably on the capital available and the quantities of fish to be smoked. For smoking small quantities of fish, a barrel with the lower end of one or two staves removed, is placed on the ground over a small pit, in which the fire is made. The fish for smoking are hung from rods supported at the top of the barrel, and the barrel is then covered with sacking or coarsely woven cloth to keep the smoke in. Fuel may be placed on the fire through the holes made in the barrel by the removal of the staves. In China long narrow furnaces about 3 ft. high and 3 ft. wide are constructed of stone or concrete, with holes in the top. The smoke from the fire passes through the holes to the fish, which are contained in baskets.

Drying.—Drying preserves fish by destroying enzymes and removing water which is necessary for bacterial growth. Fish having a fat content of over 0·2 per cent., however, is not suitable for dehydration by ordinary processes since on storage of the fish the oil contained in it becomes rancid.

Methods of drying fish differ according to the locality. The main principles consist, however, of washing and eviscerating the fish and then drying them, usually in the sun, although where suitable plant is available they may be dried in moving air currents or in vacuo. The more rapidly the fish are dried, the more rapidly they may be re-hydrated when required for use. In some districts the fish are salted or boiled for a short time before being dried. Where unfavourable weather conditions are likely to make drying difficult and prolonged, preliminary salting is probably advisable. For drying, the fish may be hung on poles or placed on mats in the sun.

Although dehydration of fish helps to prevent autolytic changes and bacterial growth, it does not prevent oxidation of the fat in the fish. Dried fish should, therefore, be stored away from sunlight and warm air. Storage in vacuo or in inert gas such as carbon dioxide is preferable, where possible, although where the fish is for fairly immediate consumption such precautions need not be taken.

Dried fish normally weighs only about one-tenth of its weight when fresh, and in this form it can be economically stored and transported.

Literature.—Further information on the preservation of fish is contained in the following selected list of publications :

"Marine Products of Commerce." By D. K. Tressler, 1923. (New York : The Chemical Catalog Co., Inc., 19 East 24th Street, price $12.)

"Report on a Preliminary Survey of the Marine Fisheries of the Zanzibar Protectorate." By C. von Bonde. (Obtainable from the Government Printer, Zanzibar.)

"Cured Marine Products of Ceylon." By P. E. P. Deraniyagala. An article in the *Ceylon Journal of Science*, Vol. V, Section C, Fisheries, September 21, 1933. (Obtainable from the Government Press, Colombo, Ceylon, price Rs. 3.)

"The Commercial Freezing and Storage of Fish." By E. D. Clark and Lloyd H. Almy. United States Department of Agriculture, *Bulletin No.* 635, March 9, 1918. (Obtainable from the Superintendent of Documents, Government Printing Office, Washington, D.C.)

"The Freezing and Cold Storage of Fish." By John T. Clark, Jnr. An article in *Food Manufacture*, Vol. V, No. 3, March 1930. (Obtainable from Messrs. Leonard Hill, Ltd., 231-232 Strand, London, W.C.2, price 1s.)

"Improvements in Process of Salting River Herring,

especially adapted to warm climates." By Harden F. Taylor. *Document No.* 903 *of the United States Bureau of Fisheries,* issued May 7, 1921. (Obtainable from the Superintendent of Documents, Government Printing Office, Washington, D.C.)

"Principles involved in the Preservation of Fish by Salt." By Harden F. Taylor. *Document No.* 919, *United States Bureau of Fisheries,* issued February 4, 1922.

Administration Report of the Madras Fisheries Department for the year 1926-1927. (Obtainable from the Superintendent, Government Press, Madras, price Rs. 1.)

"Methods of Smoking Fish around Manila Bay." By Claro Martin. An article in the *Philippine Journal of Science,* Vol. LV, September-December 1934. (Obtainable from the Bureau of Printing, Manila.)

"Carbon-Dioxide in handling Fresh Fish." By Maurice E. Stansby and Francis P. Griffiths. An article in *Industrial and Engineering Chemistry,* Vol. XXVII, No. 12, December 1935. (Obtainable from the Editorial Offices, Room 706, Mills Building, Washington, D.C., price $0.75.)

"Oat Flour Improves Keeping Quality of Fatty Fish." By J. M. Lemon, M. E. Stansby and C. E. Swift. An article in *Food Industries,* October 1937. (Obtainable from the McGraw-Hill Publishing Company, Inc., 99-129 North Broadway, Albany, New York, price 35 cents.)

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AGRICULTURE

Soils

Palestine.—According to the report of the Acting Director of Agriculture for the half-year ending June 30, 1939, the Soils Section of the Jewish Agency Research Station, Rehovot, has been paying special attention to a study of irrigated soil areas in Emek Yezreel in connection with the problem of soil salinity. Experiments on the influence of different irrigation methods on soil condition and crop yield and chemical composition have been continued. Field experiments with a view to determining the maximum salt content permissible in irrigation water have been put under way. Leaching experiments in lysometers on soils containing common salt alone or common

salt plus calcium sulphate in undesirably high concentrations are being conducted.

Sulphur was shown in plot experiments to favour the conversion of Trans-Jordan phosphorite into an available form (Lipman-Process) in red sandy clay but not in heavy clay soils.

A paper on "The Effect of Saline Water on Mediterranean Loess Soils" was published by Mr. Puffeles in the *Journal of Soil Science*, 1939, **47**, 447-453.

Beverages

Coffee

Uganda.—The report of the Bukalasa Experiment Station for the half-year ending June 30, 1939, contains the following records of coffee experiments harvested during the period under review.

(*a*) *Shade and Ground Treatment.*—No significant results were obtained from this season's crop, and a small crop was harvested owing to the heavy stumping programme which has had to be carried out for the last two years. The yields to date are as follows:

Tons per acre—Fresh Cherry

Treatment.	Clean Weeding.	Permanent Cover Crop.	Totals.
Gliricidia shade	25·4	23·5	48·9
Banana shade	22·1	22·1	44·2
No shade	23·1	19·5	42·6
Totals	70·6	65·1	135·7

(*b*) *Ground Treatment Experiment*—The mulched plots gave a much greater increase in yield over the clean-weeded plots than usual, and the permanent cover crop plots yielded nearly as well as the clean-weeded plots.

Tons per acre—Fresh Cherry

Treatment.	1938/39 Crop.	Total for 5 Seasons.
Clean weeding	2·79	19·35
Mulch (Elephant grass)	4·95	23·52
Permanent cover crop	2·74	13·20
Weed cover	1·78	9·41

(*c*) *Shade and Ground Treatment Experiment No. 2.*—The following table summaries the yields to date (three seasons):

Tons per acre—Fresh Cherry

Treatment.	No Shade.	Gliricidia Shade.	Total.
Clean weeding	4·7	4·1	8·8
Full mulch	4·3	4·4	8·7
Alternate row mulch . .	4·9	3·5	8·4
October-March cover crop .	3·4	3·2	6·6
Total . .	17·3	15·2	32·5
No manure	8·5	6·6	15·1
Cotton seed (1 tin per tree per year)	8·5	8·9	17·4

It is interesting to note that the response to manure is considerable under shade but negligible in the open.

It is stated in the report on the Kampala Plantation for the same period that the process of handing over the plantation to the township authorities was commenced at the beginning of the year, and by the end of June much of the coffee had been cut out by them. Progeny of all important varieties, species and hybrids has been established at the new Research Station at Kawanda; seed of some of the interesting hybrids was supplied to the Geneticist, Amani, who paid a visit to Uganda in February in order to carry out cytological examination of the mother trees.

The detailed results of sampling to discover the distribution of coffee roots in the soil of plots on the Kampala Plantation have been worked out (cf. this BULLETIN, 1939, **37**, 202). By means of a soil auger (3 in. in diam.) cores were taken in these plots at distances of 1 ft., 2 ft., 3 ft., 4 ft. and 5 ft. from the coffee bushes, and at varying depths up to 2 ft.; the roots were picked out with forceps, preserved in dilute formalin, mounted in lines on ruled paper and measured. The results are given in the table below:

Plot and treatment.	Average length of roots (inches) per cubic inch of soil at varying depths.				
	0–3"	3"–6"	6"–12"	12"–18"	18"–24"
A. Robusta coffee under *Centrosema pubescens* cover . . .	9·2	3·4	2·7	1·1	0·7
B. Robusta coffee, weeds slashed . . .	9·1	5·9	2·8	1·2	0·4
C. Robusta coffee under Elephant grass mulch	38·0	11·1	3·9	0·7	0·7
D. Robusta coffee, weeds removed by hand .	11·4	4·2	2·0	1·4	0·5
E. Arabica coffee . .	1·4	1·1	0·7	0·5	0·3

These figures are very interesting in that they demonstrate the great difference between the root system of Arabica and Robusta coffee—the latter species has a great proportion of its roots in the top six inches of soil. On account of this surface rooting habit the Robusta suffers greatly from root competition with other plants—the plot under *Centrosema pubescens* cover and the slashed plot (which became covered with grasses) both turned yellow in times of drought, whereas the mulched plot and the clean weeded plot (which was undisturbed, the weeds being pulled out by hand) remained green. Secondly, the figures show how mulching encourages the surface rooting habit and how severe a check is given to the coffee when mulch is dug in and so a high proportion of the roots are cut off in the process.

Fruits

Citrus

Palestine.—The report of the Acting Director of Agriculture for the period January to June 1939 states that a scheme of research into citrus fruit wastage was undertaken in co-operation with the Agricultural Research Station of the Jewish Agency at Rehovot and the Department of Scientific and Industrial Research, England. The scheme, which was well designed to achieve its purpose, comprised the investigation into the causes of citrus fruit rots in Palestine, a study of shipboard conditions and inspection of trial shipments. The research revealed that the heavy wastage is attributable almost entirely to the action of green mould, *Penicillium digitatum*, and stem end rot, *Diplodia* sp. The local investigations showed that most of the decay due to mould appeared in the course of the first two weeks of storage, whilst the rots due to Diplodia generally developed during the third and fourth weeks.

The incidence of these rots increased steadily during the shipping period. Diplodia was at its worst towards the end of the season, and in samples stored in Palestine the wastage was equal to, or greater than, that from Penicillium ; in the exported fruit, the wastage from Diplodia was less serious, probably because of the lower temperature.

Examination of fruit from different groves showed considerable variation as regards the incidence of rots, indicating that grove conditions have an important influence on fruit wastage. Careless handling of fruit and lack of sanitation in some groves are known to be contributing factors to the development of Penicillium rot. There is also some indication, arising out of last season's investigations, that the susceptibility of fruit to mould attack may be increased when restriction in irrigation is practised.

The work of previous years as to the source of Diplodia

infection being mainly on dry twigs and branches was confirmed; these are to be found generally in old groves.

The extensive survey which was undertaken at the inspection points as to the condition of oranges before export showed numerous blemishes of great variety, most of which to a greater or lesser degree increase the susceptibility of the fruit to mould wastage.

The investigations this season have, in the main, borne out the conclusions of previous work, that wastage from moulds and stem end rot increases directly with temperature, and indicate that a considerable saving in wastage and improvement in the quality of the fruit might be effected by refrigeration. Diplodia rots, for example, were not found to be serious last season at temperatures below 60° F.

An examination of a number of experimental consignments and a comparison of these with commercial shipments indicated that pre-shipment factors have as great, if not greater, effect on wastage as conditions during shipment, and further investigation and improvement in methods of handling and preparation of the fruit for market appear to be highly desirable. It has been suggested that further investigation as to the influence of ventilation on the relative humidity in the cargo spaces needs undertaking, since, as shown by Tomkins in 1937, the relative humidity is known to affect the extent of rotting.

A survey of flesh temperature of the fruit at discharge of the cargo was undertaken by the staff of the Department of Scientific and Industrial Research, and it has achieved its main purpose, i.e. to define the distribution of temperature to be expected in various positions in the holds, information which will greatly facilitate the planning of further work. Wide variations of temperature in different parts of the holds have been confirmed.

In reviewing the first season's work it may be said that, generally, the results which it was hoped to achieve when the programme was formed have been realised. The surveys which have been undertaken confirm the very heavy wastage which takes place in citrus exports, and have further defined the causes for it. The conclusions point to definite lines of research and of improvement in the exported product which must be undertaken by investigators and exporters in a joint effort to reduce the loss occasioned by wastage.

Uganda.—According to the report of the Kampala Plantation for the half-year ending June 30, 1939, during the last two years arrangements have been made to establish at Kawanda specimens of all the types of fruit growing at Kampala. Seedlings have been planted of all the different species which fruit at Kampala, as well as budded plants of all

the varieties of citrus. Seedlings of Pomelo, Sour Orange and Rough Lemon have been tested as stocks; the Pomelo was of no value; a good proportion of success was obtained on the Sour Orange stocks, but the growth has been very stunted; but all types have done well on Rough Lemon stock, which has been used exclusively in the last two years.

Deciduous Fruits

Palestine.—According to the report of the Acting Director of Agriculture for the half-year ending June 30, 1939, the delayed foliation of deciduous fruit trees under Palestinian conditions continues to occupy the attention of the Divisions of Horticulture and Plant Physiology of the Jewish Agency Agricultural Research Station, Rehovot. Experiments testing the effect on foliation of different oil sprays at different times of application have been carried out. Concurrently, breeding experiments on apples with a view to combining early foliation with commercially desirable fruit properties have been put under way.

A phytopathological survey of deciduous fruit in the hilly regions emphasised the economic importance of root and root collar fruit diseases. A report on the insect pests of deciduous fruit trees in the hills is in preparation.

Grapes

Palestine.—According to a report by the Acting Director of Agriculture on research work carried out during the half-year ended June 30, 1939, investigations relating to the storage of table grapes, both local and introduced, were instituted. Most of the varieties kept under ordinary storage conditions showed a high percentage of wastage after a week. Those kept in cold storage at temperatures varying between 0·5° C. and 1·5° C. gave much better results.

Preliminary studies with local varieties kept for 32 to 40 days in cold storage indicate up to 80 per cent. berry drop in Marrawi, up to 50 per cent. in Salti Khedary, up to 20 per cent. in Enuni and Baluti, and about 2 per cent. in Dabuqi. Decay developed up to 50 per cent. in Baluti and Salti Khedary, about 10 per cent. in Enuni and Dabuqi, and 7 per cent. in Marrawi. Dabuqi was therefore the only local variety in these trials which showed any promise.

Of the introduced varieties, Chasselas, Lady Downe's Seedling, Emperor, Flame Tokay, Rozaki and Frankenthal showed no drop; Blue Serbian and Prune de Cazouls, 3 per cent.; Dattier de Beyrouth, Ohanez and Alphonse Lavalée, from 7 to 10 per cent.; Enab Tourki, 20 per cent.; while a heavy drop is general in Muscat de Hambourg (40 per cent.) and Muscat d'Alexandrie (50 per cent.).

Wastage in these grapes shows a low percentage of loss in Alphonse Lavallée, Prune de Cazouls, Emperor, Rozaki, Flame Tokay and Dattier de Beyrouth. A wastage of 5 to 10 per cent. was recorded in Muscat d'Alexandrie, Ohanez, Blue Serbian, Frankenthal and Chasselas. High losses resulted in Lady Downe's Seedling, Enab Tourki and Muscat de Hambourg. The introduced varieties which, therefore, show promise for storage and export are Prune de Cazouls, Alphonse Lavalée, Emperor, Flame Tokay, Dattier de Beyrouth, Rozaki and Chasselas.

The investigations further showed that certain varieties could be stored longer than others. The following varieties have kept well for over 50 days: Dabuqi, Dattier de Beyrouth, Alphonse Lavallée, Chasselas, Emperor and Flame Tokay.

Studies in the various methods of packing, viz., without wraps, in sawdust, in cork, with various wrappers, etc., definitely show that grape bunches stored in the ordinary method of packing without wrapping each bunch separately are decidedly prone to a higher percentage of wastage in comparison with those wrapped in tissue or oil paper.

Fodder Crops

Palestine.—The report of the Acting Director of Agriculture for the period January to June 1939 contains the following notes on research work on fodders carried out by the Palestine Department of Agriculture and by grant-aided and other institutions in that country.

The introduction work carried out by the Jewish Agency Agricultural Research Station, Rehovot, on irrigated green forage crops new to Palestine continues apace. Among winter green forages, *Lathyrus ochrus*, field pea, horse bean, and sweet lupine have given results which justify their being recommended for cultivation on an economic basis. Among summer green forages, sunflower, *Eragrostis abyssinica* (teff grass) and Penicillaria are winning a place of distinction.

These results clear the way for the production of a diversified and cheap supply of farm-grown green forage in adequate quantities throughout the year. Future work on forage cultivation will therefore be concentrated on kernel and pasture crops.

The group experiment testing the economic maintenance of milch cows on a high ration of green forage has been continued in the barn with good results. By diversifying with the new green forages mentioned it has been found possible to increase the participation of green roughage to 95 per cent. of the total winter feed ration while maintaining a milk production rate of 15 kilogrammes per head per day. At the same time it has been possible to replace sunflower and peanut cakes in the ration with farm-grown legume grain concentrates.

Systematic determinations of the dry matter content of different green winter forages show that the dry matter content of different forages, barring vetch, is fairly constant up to about March at about 11 to 13 per cent.; after March the dry matter content rises, regardless of sowing time, age of plants, or number of cuts, to about 30 per cent. The dry matter yield per unit area, on the other hand, rises steadily throughout.

Pit silage experiments with a view to the economic provision of legume feeds for the summer season have been carried out. With mixtures of horse-bean and non-legume feeds such as oats, barley, orange or grapefruit, promising results have been recorded. A large-scale silage experiment was conducted this year also with whole orange culls. This material gave a good silage feed, but some loss of juice was noted. Experiments on the ensilage of potato foliage and stock-beet mixtures are under way.

Digestibility experiments with sheep were carried out during the period under review with carob pod, ground carob bean, orange fruit, and local legumes known as kersenna (*Lathyrus* sp.) and jilbana (*Vicia sativa*). The latter two were found to be rich in protein, rating 20 per cent. of this constituent. The excellent feeding value of oranges was confirmed.

Experiments are being carried out at the Daniel Sieff Research Institute, Rehovot, on carob seeds and the fermentation of carob meal. At the present juncture it appears to be too early to submit any definite results.

Field experiments conducted by the Plant Protection Service of the Department for the control of the larvae of the moth *Prodenia litura* Boisd. by the use of a sodium or barium fluosilicate bran bait in the proportion of 10 to 1 by weight have given satisfactory results. Water must be added in sufficient quantity to moisten the bait.

Fibres

Uganda.—The report of the Kampala Plantation for the half-year January to June 1939 mentions that a sample of fibre from *Abroma augusta* grown and prepared on the Plantation in 1935 received a good report from the Imperial Institute, and steps were taken to produce a bulk sample for spinning tests. An area of five acres was planted with the crop but, owing to the poor germinating capacity of the seed, it was difficult to obtain a good stand of plants; continual replanting was necessary. Whenever the stems have reached the correct stage for cutting, i.e. when the flowers commence to open, they have been cut; the bark has been stripped and retted to extract the fibre. The plants have stood the process of coppicing quite well, though a few of the older ones have

died; but, as the plants increased in age, the growth has been less vigorous, the stems shorter, and it is probable that the fibre will not be of such good quality.

Other fibre plants which have recently been tried at Kampala include Manila hemp (*Musa textilis*) and *Hibiscus kitaibelifolius*. A sample of Manila hemp prepared last year has received a report that it was lacking in the usual lustre and strength of Manila hemp and was worth less than £19 10*s*. per ton. At this figure the crop shows little promise in Uganda, when the cost of extraction is taken into account. *Hibiscus kitaibelifolius* also shows little promise; only a few plants were raised from seed from Rio de Janeiro, and these have made short spreading growth; it appears that their bark is much less suited to fibre extraction than that of some of the *Hibiscus* spp. indigenous to Uganda, none of which has been found to give any prospect of value for export.

FORESTRY

Nigeria.—The following reports have been furnished by the Acting Chief Conservator of Forests.

1. *Research work conducted during the period July-December* 1938.—The work carried out by the Working Plans and Research Circle during the period was mainly confined to the working up of accumulating enumeration survey statistics and the preparation of data for the first Divisional Working Plan which was prepared for a large area of valuable reserved forest in Benin Province.

Twelve miles of linear sample plot for further detailed growth statistics were laid down in rain forest, and remeasurements of existing sample plots were carried out. With the advent of the dry season in November enumeration survey work was resumed in the Benin Forests.

The Forest Utilisation Division continued the investigations of various wood preservatives, and further "grave-yard" tests confirmed and enlarged previous experience of the natural durability of Nigerian timbers. The open-type impregnation tank was in constant use, sleepers, telegraph poles and shingles forming the main type of material treated.

For demonstration purposes and to ensure the use of local timber in every possible way several small huts and houses were constructed. These buildings were roofed with shingles, which aroused considerable interest and favourable comment.

As regards minor forest products some investigations were made in Calamus canes and beeswax, and a sample of gum copal was sent to the Imperial Institute.

2. *Research work conducted during the period January-June* 1939.—The Forest Utilisation Division has made considerable progress in the investigation of the utilisation of secondary

timbers, the relative value of the principal wood preservatives, costs and methods of treatment, and rates of absorption. Model buildings have been erected using secondary timbers which have proved to be of value from a propaganda point of view, so much so that requests have been received from outside sources to construct buildings of a similar nature.

The timber testing laboratory, which was built in 1938, has been extensively used, and reports on 32 timbers of Southern Nigeria and 30 timbers of Northern Nigeria have been submitted, which consist of tables of strength, toughness, hardness and general physical characters.

The plant in the Utilisation Yard has been greatly enlarged, and extensive tests have been carried out on the strength, working qualities and absorption capacities of most of the more promising secondary timbers. Progress has been somewhat retarded during the last few months by the breakdown of the power plant, but it is hoped to have new machinery installed in the future which will provide far greater scope in the propaganda for the utilisation of Nigerian timbers. Methods of timber impregnation have been improved, and a steam heating installation for preservatives is being constructed.

One of the most important schemes which has been sanctioned is an experimental mile of railway track in which sleepers of secondary timbers are to be used.

The secondary timber exploitation scheme referred to in the report for January to June 1938 (see this BULLETIN, 1938, **36**, 397) has now been handed over to a Forest Circle, and satisfactory progress has been made in the working of poor secondary forest by a system of "split-saw" conversion by contract. Finally, it is hoped that future exploitation will be carried out in conjunction with the recommendations of Major Chipp's recent report on sawmilling.

BIBLIOGRAPHY

Comprising the more important reports, articles, etc., contained in publications received in the Library of the Imperial Institute during the three months August-October 1939.

The publications issued by the Governments of the Colonies and Protectorates can be obtained from or through the Crown Agents for the Colonies, 4 *Millbank, Westminster, S.W.*1. *Applications for Dominion and Indian Government publications may be made to the Offices of the High Commissioners or Agents-General in London.*

AGRICULTURE

General

Report of the Department of Agriculture of British Honduras for the year 1938. Pp. 33, 13 × 8. (Belize: Government Printer, 1939.)

Administration Report of the Commissioner for Development of

Agricultural Marketing, Ceylon, for 1938. Pp. 13, 9¾ × 6. (Colombo: Government Record Office, 1939.) Price 15 cents.

An Analysis of Farming Costs in Cyprus. By H. M. James and C. C. Koumides. *Cyprus Agric. J.*, 1939, **34**, 46-67.

Annual Report of the East African Agricultural Research Station, Amani, for 1938. Pp. 56, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 1*s.*

Annual Bulletin of Divisional Reports of the Department of Agriculture, Fiji, for 1938. Pp. 106, 9¾ × 6. (Suva: Government Printer, 1939.) Price 2*s.* 6*d.*

Report of the Department of Agriculture, Colony of the Gambia, for the period ending May 31, 1939. Pp. 15, 12 × 8½. (Bathurst: Government Printer, 1939.) Price 2*s.*

Report of the Hawaii Agricultural Experiment Station for 1938. Pp. 101, 9 × 6. (Honolulu: Agricultural Experiment Station, 1939.)

Annual Report of the Superintendent, Botanical and Forestry Department, Hong Kong, for the year 1938. Pp. 17, 13 × 8. (Hong Kong: Government Press, 1939.) Price 60 cents.

Annual Report of the Department of Agriculture, Assam, for the year 1937-38. Pp. 206, 9½ × 6½. (Shillong: Government Press, 1939.) Price Rs. 2 As. 7.

Annual Report of the Department of Agriculture, Bengal, for the year 1937-38. Part I. Pp. 20, 9¾ × 6¼. (Alipore, Bengal: Superintendent, Government Printing, 1938.) Price As. 8.

Report of the Board of Agriculture, Isle of Man, for the year ended March 31, 1939. Pp. 30, 9¾ × 7½. (Douglas, I.O.M.: Board of Agriculture, 1939.) Part I deals with the Experimental Farm for the year ended November 12, 1938, and Part II covers the work of Agricultural Organisation for the year ended March 31, 1939.

Annual Report of the Department of Agriculture, Malta, for 1937-38. Pp. 71, 12 × 8¾. (Malta: Government Printing Office, 1939.)

Annual Report of the Department of Agriculture, New Zealand, for 1938-39. Pp. 72, 13 × 8½. (Wellington, N.Z.: Government Printer, 1939.)

Annual Report of the Cawthron Institute, Nelson, New Zealand, for 1938. Pp. 35, 9½ × 6. (Nelson, N.Z.: Cawthron Institute, 1939.)

Annual Report of the Department of Agriculture, North Borneo, for 1938. Pp. 17, 13½ × 8. (Sandakan: Government Printing Office, 1939.)

Annual Report of the Department of Agriculture, Nyasaland, for 1938. Pp. 95, 13 × 8. (Zomba: Government Printer, 1939.) Price 2*s.* 6*d.*

Report by Sir Frank Stockdale, K.C.M.G., C.B.E., on a visit to St. Helena, 1939, including a Report on Agriculture in St. Helena by Mr. R. S. Ball. Pp. 64, 9½ × 6. (London: Colonial Office, 1939.)

Report of the Agricultural Department, St. Kitts-Nevis, for the year 1938. Pp. 60, 12½ × 8. (Trinidad: The Imperial College of Tropical Agriculture, 1939.) Price 6*d.*

Report of Commission to enquire into the Preservation, etc., of the Natural Resources of Southern Rhodesia. Pp. 76, 13¼ × 8. (Salisbury: Government Stationery Office, 1939.)

Annual Report of the Director of Gardens, Straits Settlements, for 1938. Pp. 14, 9½ × 6. (Singapore: Government Printing Office, 1939.) Price $1.

Report of the Entomologist, Department of Agriculture, Tanganyika Territory, for 1938. *Ento. Leafl. No.* 17, *Dep. Agric. Tanganyika.* Pp. 5, 9½ × 6. (Dar es Salaam: Government Printer, 1939.) Price 50 cents.

Annual Report of the Department of Agriculture, Uganda Protec-

torate (Part I), for the year ended December 31, 1938. Pp. 70, 9¾ × 6. (Entebbe: Government Printer, 1939.) Price Shs. 3. Contains a review of the agricultural activities and a record of work of the administrative and educational sections of the Department.

The Soviet Ukraine. Its People and Agriculture. By L. G. Michael. *Foreign Agric.*, 1939, **3**, 281-306.

Report of the Low Temperature Research Laboratory, Division of Plant Industry, Department of Agriculture and Forestry, Cape Town, for the year June 1936 to June 1937. Pp. 184, 9½ × 7¼. (Pretoria: Government Printer, 1938.)

Comptes-Rendus et Rapports du VII_e Congrès International d'Agriculture Tropicale et Subtropicale, Paris, 1937. Pp. 451, 9½ × 6¼. (Paris: Association Scientifique Internationale d'Agriculture des Pays Chauds, 1939.)

Planning for a Permanent Agriculture. Including a Summary of the Programs Administered by the Department of Agriculture that Influence the Use of the Land. *Misc. Publ. No.* 351, *U.S. Dep. Agric.* Pp. 71, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 15 cents.

Gyrotiller Cultivation and Crop Yield. By I. D. Blair. *N.Z. J. Sci. Tech.*, 1939, **21**, 96A-102A.

Profitability of Irrigation Farming in the Western Transvaal. By F. R. Tomlinson. *Bull. No.* 201, *Dep. Agric. Un. S. Afr.* Pp. 45, 9½ × 6. (Pretoria: Government Printer, 1939.) Price 3*d*.

Terrace Outlets and Farm Drainageways. By C. L. Hamilton. *Frms'. Bull. No.* 1814, *U.S. Dep. Agric.* Pp. 45, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Experiments in Bracken Cutting. By K. W. Braid. *Scot. J. Agric.*, 1939, **22**, 215-225.

Prickly Pear Eradication and Control. By W. H. Dameron and H. P. Smith. *Bull. No.* 575, *Tex. Agric. Exp. Sta.* Pp. 55, 9 × 6. (Brazos County, Texas: Agricultural Experiment Station, 1939.)

Water Hyacinth in South Australia. By W. J. Spafford. *J. Dep. Agric. S. Aust.*, 1939, **42**, 972A-975A.

The Soil

Soil Stabilisation by Heat Treatment. By G. W. Eckert. *Chem. and Ind., Lond.*, 1939, **58**, 846-851.

An Investigation of the Problems of Salt Accumulation on a Mallee Soil in the Murray Valley Irrigation Area. By J. E. Thomas. *Bull. No.* 128, *Coun. Sci. Industr. Res. Aust.* Pp. 88, 9½ × 6. (Melbourne: Government Printer, 1939.)

Sand-dune Reclamation in the Southern Great Plains. By C. J. Whitfield and J. A. Perrin. *Frms'. Bull. No.* 1825, *U.S. Dep. Agric.* Pp. 13, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Molasses and Press Mud in *Usar* (Alkali) Land Reclamation. By N. R. Dhar. *J. Indian Chem. Soc., Industr. and News Ed.*, 1939, **2**, 105-111.

Maintenance of Vegetative Cover in New Zealand, with special reference to Land Erosion (Report of Committee of Inquiry). *Bull. No.* 77, *Dep. Sci. Industr. Res. N.Z.* Pp. 51, 9½ × 6. (Wellington, N.Z.: Government Printer, 1939.)

Deforestation and Soil Erosion in Trinidad. Deforestation and Soil Erosion in the Foothills of the Northern Range caused by Shifting Cultivation. By J. C. Cater. *Trop. Agric., Trin.*, 1939, **16**, 230-232.

Soil Defense of Range and Farm Lands in the South-west. By

E. M. Rowalt. *Misc. Publ. No.* 338, *U.S. Dep. Agric.* Pp. 51, 8½ × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Tsetsebekämpfung und Bodenerosion. By F. Zumpt. *Tropenpflanzer*, 1939, **42**, 317-323.

The Quantity, Distribution and Composition of the Organic Matter and Available Nitrogen in Egyptian Soils. By D. S. Gracie and Fahmy Khalil. *Bull. No.* 222, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 42, 10½ × 7. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price P.T.5.

Fertilisers in Modern Agriculture. By Sir E. J. Russell. *Bull. No.* 28, *3rd Ed., Minist. Agric. Lond.* Pp. 216, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 4*s*.

Comparison of Different Methods of Composting Waste Materials. By C. N. Acharya. *Indian J. Agric. Sci.*, 1939, **9**, 565-572.

Wealth from the Dustbin. By R. D. Anstead. *Trop. Agric., Trin.*, 1939, **16**, 206-207. An account of the manufacture of compost from town refuse.

Pests—General

Some Mealy Bugs of Egypt and Experiments on their Control by means of Chemicals. By M. Beshir and M. Hosny. *Bull. No.* 209, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 16, 10½ × 7. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price P.T.2.

The Control of Mole-Crickets with Barium Fluosilicate. By A. Kassab. *Bull. No.* 193, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 13 + 7 plates, 10½ × 7. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price P.T.4.

The Bionomics, Life-history and Control of the Grasshopper *Poecilocerus pictus* Fab.—A New Pest of Cultivated Crops in North India. By Hem Singh Pruthi and L. N. Nigam. *Indian J. Agric. Sci.*, 1939, **9**, 629-641.

Grasshoppers and their Control. By J. R. Parker. *Frms.' Bull. No.* 1828, *U.S. Dep. Agric.* Pp. 37, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Field Observations on the Brown Locust in an Outbreak Centre. By C. J. B. Smit. *Sci. Bull. No.* 190, *Dep. Agric. Un. S. Afr.* Pp. 143, 9½ × 6. (Pretoria: Government Printer, 1939.) Price 1*s*.

Field Observations on the Red Locust at Lake Rukwa in 1936 and 1937. By A. Lea and D. van V. Webb. *Sci. Bull. No.* 189, *Dep. Agric. Un. S. Afr.* Pp. 81, 9½ × 6. (Pretoria: Government Printer, 1939.) Price 6*d*.

Domestic Mosquitoes. By F. C. Bishopp. *Leafl. No.* 186, *U.S. Dep. Agric.* Pp. 8, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Household Insects and their Control. By A. Gibson and C. R. T. Winn. *Publ. No.* 642, *Dep. Agric. Canada.* Pp. 100, 9¾ × 6½. (Ottawa: Departments of Agriculture, 1939.) Price 25 cents.

The Control of Household Insects in South Africa. By B. Smit. *Bull. No.* 192, *Dep. Agric. Un. S. Afr.* Pp. 52, 9½ × 6. (Pretoria: Government Printer, 1938.) Price 6*d*.

Rats and How to Exterminate Them, with a Note on Grey Squirrels. *Bull. No.* 30 (*5th Ed.*), *Minist. Agric. Lond.* Pp. 17, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 6*d*.

Insecticides

(See p. 591)

Diseases—General

A List of Plant Diseases recorded in New Zealand. By R. M. Brien. *Bull. No.* 67, *Dep. Sci. Industr. Res. N.Z.* Pp. 39, 9½ × 6. (Wellington, N.Z. : Government Printer, 1939.)

Foodstuffs—General

Food from the Garden. *Growmore Bull. No.* 1, *Minist. Agric. Lond.* Pp. 20, 9½ × 6. (London : H.M. Stationery Office, 1939.) Price 3*d.*

Botanical Survey of India. Catalogue of Food, Spice and Fodder Plant Exhibits in the Industrial Section of the Indian Museum. By S. N. Bal. Pp. 73, 9½ × 6¼. (Delhi : Manager of Publications, 1939.) Price Rs. 4.

Desiccation of Frozen Food. By S. F. Hadfield. *Fruit Prod. J.*, 1939, **19**, No. 2, 41-44, 59.

Beverages

Eighth Annual Report on Cacao Research, 1938. Pp. 42, 11 × 8½. (Trinidad : Imperial College of Tropical Agriculture, 1939.) Price 5*s.*

The Maximum Yield of Cacao. A Discussion of Some Factors that Contribute to High Production. *Trop. Agric., Trin.*, 1939, **16**, 179-191.

Growth Rate of Cross- and Self-fertilised Cacao. By O. J. Voelcker. *Trop. Agric., Trin.*, 1939, **16**, 203-205.

Het Stekken van Koffie. By P. A. Roelofsen. *Bergcultures*, 1939, **13**, 994-1002. The planting of coffee.

Problemen van de Robustakoffie-cultuur. By C. Coolhaas. *Ind. Mercuur*, 1939, **62**, 563-564.

Catalogue des principaux Insectes et Nématodes Parasites des Caféiers au Congo Belge. By H. J. Brédo. *Bull. Agric. Congo Belge*, 1939, **30**, 266-307.

Observations on the Life-history and Control of White Borer of Coffee in Kenya. By C. D. Knight. *E. Afr. Agric. J.*, 1939, **5**, 61-67.

Observations sur la Maladie Verruqueuse des Fruits du Caféier. By F. L. Hendrickx. *Publ. No.* 19, 1939, *Sér. Scientif. Inst. Nat. Étude Agron. Congo Belge.* Pp. 12, 9½ × 6. (Brussels : Institut National pour l'Étude Agronomique du Congo Belge, 1939.) Price 3 Fr.

Report of the International Tea Committee, April 1938 to March 1939. Pp. 41, 8½ × 5½. (London : International Tea Committee, 1939.)

Annual Report of the Tea Research Institute of Ceylon for 1938. Pp. 78, 9½ × 6. (St. Coombs, Talawakelle : Tea Research Institute, 1939.)

Disease in Non-productive [Tea] Bushes. By C. H. Gadd. *Tea Quart.*, 1939, **12**, 75-86. An account of the phloem necrosis disease.

Tortrix Control. By C. B. R. King. *Tea Quart.*, 1939, **12**, 86-91.

Cereals

Corn Culture in the Philippines. *Philipp. J. Agric.*, 1939, **10**, 195-202.

Tests of Corn Varieties and Hybrids in Utah. By R. W. Woodward, D. C. Tingey and R. J. Evans. *Bull. No.* 287, *Utah Agric. Exp. Sta.* Pp. 32, 9 × 6. (Logan, Utah : Agricultural Experimental Station, 1939.)

Cultivation of Paddy. *Trop. Agric., Ceylon*, 1939, **93**, 81-87.

A statement relating to the cost of paddy cultivation at the Experiment Station, Anuradhapura.

Notes on an Attempt to Estimate Threshing Qualities in Padi. By Tunku Yacob Bin, Sultan Abdul Hamid and J. A. Baker. *Malay. Agric. J.*, 1939, **27,** 269-270.

Le Tiêm des Riz d'Indochine. Le Problème de la Lutte contre cette Grave Maladie. By A. Chevalier. *Rev. Bot. Appl.*, 1939, **19,** 465-479. Discusses the various diseases of rice which cause low yields and which are known under the name " le Tiêm " in Annam.

Pythium Root Rot of Milo (*Sorghum vulgare*) and the Development of Resistant Varieties. By J. B. Kendrick and F. N. Briggs. *Bull. No.* 629, *Calif. Agric. Exp. Sta.* Pp. 18, 9 × 6. (Berkeley, Calif. : Agricultural Experiment Station, 1939.)

Wheat-growing in Queensland. By R. E. Soutter. *Queensld. Agric. J.*, 1939, **51,** 581-617.

A Spacing Experiment with Egyptian Wheats. By J. Philp. *Bull. No.* 199, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 83 + 7 plates, 10½ × 7. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price P.T.10.

Field Experiments on the Effect of Applying a Nitrogenous Fertiliser to Wheat at Different Stages of Growth. By D. J. Watson. *J. Agric. Sci.*, 1939, **29,** 379-398.

Breeding Rust Resistant Wheat. By G. T. Kale. *Int. Rev. Agric.*, 1939, **30,** 325T-330T. A review of work done or in progress in certain European countries.

Sugar

Sugar Cane in the Punjab. II. By P. E. Lander and Ramji Narain. *Indian J. Agric. Sci.*, 1939, **9,** 381-421. A survey of the sugar production in the various districts of the Punjab.

Double *versus* Single Planting of Sugar Cane. By C. H. B. Williams and L. A. Forte. *Agric. J. Brit. Guiana*, 1939, **10,** 89-95.

Sugar Cane Planting Experiments, 1933-1937. By A. H. Rosenfeld. *Bull. No.* 195, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 40, 10½ × 7. (Bulâq, Cairo : Publications Office, Government Press, 1939.) Price P.T.7.

Manurial Requirements of Sugar Cane in Egypt. III. Further Rate of Nitrogen Experiments. By A. H. Rosenfeld. *Bull. No.* 203, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 24, 10¾ × 7. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price Mills. 35.

The Effect of Rain on Cut Cane. By H. W. Kerr and J. M. MacGibbon. *Aust. Sug. J.*, 1939, **31,** 165.

Further Tonnage Tests of Imported Sugar Cane Varieties. By A. H. Rosenfeld. *Bull. No.* 196, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 9, 10¾ × 7. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price Mills. 15.

The Amazon Fly (*Metagonistylum minense* Towns.) in British Guiana. By L. D. Cleare. *Agric. J. Brit. Guiana*, 1939, **10,** 55-77. An account of the introduction and colonisation of this parasite of *Diatræa* spp. in the colony.

A Summary of Experimental Work on Varietal Resistance of Sugarcane to *Tomaspis saccharina*, 1936-39. By R. G. Fennah. *Trop. Agric., Trin.*, 1939, **16,** 233-240.

Transmission of Sugarcane Mosaic by Aphids. By H. D. Tate and S. R. Vandenberg. *J. Agric. Res.*, 1939, **59,** 73-79.

The Inheritance of Gumming Disease Resistance in Sugarcane Breeding. By G. C. Stevenson. *Bull. No.* 15, *Sug. Res. Sta. Mauritius.* Pp. 9, 9½ × 6. (Port Louis: Government Printer, 1939.) Price 15 cents.

Alternate Hosts of *Bacterium vasculorum*, the Causal Agent of Gumming Disease of Sugar Cane. By C. G. Hughes. *Tech. Commun. No.* 3, 1939, *Bur. Sug. Exp. Sta. Queensld.* Pp. 63, 9½ × 7¼. (Brisbane: Government Printer, 1939.)

The Preparation and Painting of Maple Sugar-producing Equipment. By C. O. Willits and C. J. Tressler. *J. Agric. Res.*, 1939, **59**, 151-158.

Root Crops

The Control of Potato Slugs. By A. E. Cameron. *J. Minist. Agric.*, 1939, **46**, 454-462.

Some Notes on the Potato Tuber Moth (*Phthorimæa operculella* Zell.). By Rizk Attia and Bishara Mattar. *Bull. No.* 216, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 136, 10¾ × 7¾. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price P.T.10.

Onderzoekingen over Aardappelziekten. By H. R. A. Muller. *Meded. No.* 33, *Alg. Proefst. Landb., Batavia.* Pp. 22, 9¾ × 7. Buitenzorg: Archipel Drukkerij, 1939.) Price f.0.30. Investigations on potato diseases.

Fruits

The Fruit and Vegetable Grower in Wartime. Proper Manures for increased Output. By Sir E. J. Russell. *Fruit-Gr., Lond.*, 1939, **88**, 485-486.

La Frutticoltura e la Viticoltura nella Libia Orientale. By A. Micheli. *Agric. Libica*, 1939, **8**, No. 10, 445-457. A paper on fruit and vine cultivation in East Libia presented at the Eighth International Congress of Tropical and Sub-Tropical Agriculture, 1939.

Protection of Orchards Against Frost. By W. R. Schoonover, F. A. Brooks and H. B. Walker. *Circ. No.* 111, *Calif. Agric. Ext. Serv.* Pp. 70, 9 × 6. (Berkeley, Calif.: College of Agriculture, 1939.)

Biology of and Control Experiments on the Mediterranean Fruit Fly (*Ceratitis capitata*) in the Eweg (Valley of Esdraelon). *Agric. Suppl. No.* 45, *Palestine Gaz.*, 1939, 188-192.

Nematode Disease of Stone-fruits. By Amin Fikry. *Bull. No.* 217, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 9 + 21 plates, 10½ × 7. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price Mills. 35.

Fruit Juices and Syrups: A New British Industry. By V. L. S. Charley. *J. Minist. Agric.*, 1939, **46**, 419-428.

Canadian Fruit Juices. By F. E. Atkinson and C. C. Strachan. *Bottler and Packer*, 1939, **13**, No. 9, 26-30. An outline of the processes employed, equipment used, etc.

High Speed Processing and Cooling of Juices by the Thermo-Roto Process. By R. Berkness. *Fruit. Prod. J.*, 1939, **18**, No. 12, 356-357.

Canned Fruits. Laboratory Control of Raw Materials and Production Methods. By L. H. Trace. *Food*, 1939, **8**, 423-426, 461-464.

Pectin in Flavoured Products. By S. M. Tritton. *Flavours*, 1939, **2**, No. 4, 9-15. Deals with the production and uses of pectin.

Surplus Apples in War Time. By V. L. S. Charley. *Food Manuf.*, 1939, **14**, 342-344. Discusses their uses.

Codling Moth Control in the Western Province, with Special Reference to the Hot Inland Areas. By R. I. Nel and W. A. K. Stubbings. *Frmg. S. Afr.*, 1939, **14**, 365-369.

Control of Rot of Apples. By F. D. Heald. *Pop. Bull. No.* 158, *Wash. Agric. Exp. Sta.* Pp. 8, 9 × 6. (Pullman, Washington; Agricultural Experiment Station, 1939.)

The Effect of Water Core on the Keeping Quality of Apples. By H. H. Kemp and J. A. Beare. *J. Dep. Agric. S. Aust.*, 1939, **43**, 22-28.

Brown-spotting of Apricots, a Boron Deficiency Disease. By H. O. Askew. *N.Z. J. Sci. Tech.*, 1939, **21**, 103A-106A.

Banana Transport: A Comparison of Storage Conditions in a Modern Ship and in Earlier Types. By E. R. Leonard. *Trop. Agric., Trin.*, 1939, **16**, 200-202.

Black Currant Juice. By R. W. Arengo-Jones. *Bottler and Packer*, 1939, **13**, No. 9, 84, 86. Describes methods of preparation.

La Coltivazione degli Agrumi in Tripolitania. By V. Parrini. *Agric. Libica*, 1939, **8**, 398-405. The cultivation of citrus fruits in Tripoli.

Some Symptoms of Citrus Malnutrition in Florida. By A. F. Camp and B. R. Fudge. *Bull. No.* 335, *Fla. Agric. Exp. Sta.* Pp. 55, 9 × 6. (Gainesville, Florida: Agricultural Experiment Station, 1939.)

A Study of the Methods of Cultivation of Fruit Trees with special reference to Citrus. Part II. Irrigation. By Sohrab R. Gandhi. *Trop. Agric., Ceylon*, 1939, **93**, 68-75.

The Composition of Local and Imported Citrus Fruit. By A. W. R. Joachim and D. G. Pandittesekere. *Trop. Agric., Ceylon*, 1939, **93**, 14-24.

Overzicht van de Belangrijkste Citrus-ziekten in Nederlandsch Indië. By H. R. A. Muller. *Meded. No.* 34, *Alg. Proefst. Landb. Batavia.* Pp. 42, 10 × 7. (Batavia, Java: Proefstation voor den Landbouw, 1939.) Price f.0.75. Discusses the importance of citrus diseases in the Netherlands Indies.

Citrus Thrips Control. By F. J. Stofberg. *Frmg. S. Afr.*, 1939, **14**, 354.

Experiments with Oil Spray for the Control of the Mussel Scale (*Lepidosaphes pinnæformis* Bché.) [of Citrus]. By Y. Ben-Amotz. *Hadar*, 1939, **12**, 203-206.

Studies in the Biology and Control of *Pseudococcus comstocki* Kuwana on Citrus in Palestine. By E. Rivnay. *Hadar*, 1939, **12**, 197-201.

Psorosis or Scaly Bark of Citrus Trees. By E. M. Doidge. *Frmg. S. Afr.*, 1939, **14**, 363-364.

Citrus By-Products. The Possibilities of Establishing the Industry in the Union of South Africa. By D. J. Coghill. *Bottler and Packer*, 1939, **13**, No. 9, 38-40, 43-44.

Gases in the Commercial Handling of Citrus Juices. By G. N. Pulley and H. W. von Loesecke. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 1275-1278. A study of the gases present in Florida citrus juices extracted and de-aerated by different methods in the laboratory and in commercial practice.

Storage Investigations with Trinidad Grapefruit, 1938-39. By C. W. Wardlaw and E. R. Leonard. *Trop. Agric., Trin.*, 1939, **16**, 208-215.

Growth of Lemon Fruits in Relation to Moisture Content of the Soil. By J. R. Furr and C. A. Taylor. *Tech. Bull. No.* 640, *U.S. Dep. Agric.* Pp. 71, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 15 cents.

The Curing and Colouring of New Zealand Lemons. By J. B. Hyatt and O. H. Keys. *N.Z. J. Sci. Tech.*, 1939, **22**, 318B-340B.

The Indian Lime Juice Industry: Its Present and Future. By S. S. Bhat. *Agric. Live-Stk. India*, 1939, **9**, 418-431.

Beschouwingen over de Kwaliteit van Surinaamsche Sinaasappelen. By W. Spoon. *Ber. No.* 139, *HandMus. Kolon. Inst. Amst.* Pp. 10, 8½ × 5½. (Amsterdam: Koloniaal Instituut, 1939.) Remarks on the quality of oranges from Surinam. With a summary in English.

Cucumber-mosaic (Cucumis virus I of Smith, 1937). By E. E. Chamberlain. *N.Z. J. Sci. Tech.*, 1939, **21**, 73A-90A.

Fig-drying in South Africa. By J. Joubert. *Frmg. S. Afr.*, 1939, **14**, 375-376, 379.

Vine-growing in Greece. By A. J. Boyazoglu. *Int. Rev. Agric.*, 1939, **30**, 299E-326E.

Top Grafting of Grape Vines. By F. L. Jardine. *Queensld. Agric. J.*, 1939, **52**, 43-51.

Preliminary Report on Cold Storage Experiments with Grapes (1938). Summary. *Agric. Suppl. No.* 44, *Palestine Gaz.*, 1939, 164-168.

Dry Stalk in Table Grapes. Its Causes and Control. By M. S. du Toit and J. Reyneke. *Sci. Bull. No.* 191, *Dep. Agric. Un. S. Afr.* Pp. 20, 9½ × 6. (Pretoria: Government Printer, 1939.) Price 3*d.*

Sultana Farming along the Orange River. By F. C. Hugo. *Bull. No.* 184, *Dep. Agric. Un. S. Afr.* Pp. 20, 9½ × 6. (Pretoria: Government Printer, 1938.) Price 3*d.*

Market Diseases of Fruits and Vegetables, Grapes and other Small Fruits. By D. H. Rose, C. O. Bratley and W. T. Pentzer. *Misc. Publ. No.* 340, *U.S. Dep. Agric.* Pp. 26, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 40 cents.

Studies on the Manufacture of Guava Jelly. By J. I. Sulit. *Philipp. J. Agric.*, 1939, **10**, 173-184.

Processing of the Macadamia. By R. H. Moltzau and J. C. Ripperton. *Bull. No.* 83, *Hawaii Agric. Exp. Sta.* Pp. 31, 9 × 6. (Honolulu: Agricultural Experiment Station, 1939.) The preparation of the macadamia nut for the market.

Effect of Storage Temperatures on Peaches. By M. H. Haller and P. L. Harding. *Tech. Bull. No.* 680, *U.S. Dep. Agric.* Pp. 32, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

The Oriental Peach Moth (*Cydia molesta* Busck.) Investigations in the Goulburn Valley, Victoria. Progress Report for the Seasons 1935-38. By G. A. H. Helson. *Pamphl. No.* 88, *Coun. Sci. Industr. Res. Aust.* Pp. 23, 9½ × 6. (Melbourne: Government Printer, 1939.)

Pineapple Plant Selection. With Special Reference to the Elimination of Inferior Types. By H. M. Groszmann. *Queensld. Agric. J.*, 1939, **52**, 27-42.

Pineapple Propagation. A New Method in Sierra Leone. By H. Macluskie. *Trop. Agric., Trin.*, 1939, **16**, 192.

Pineapple Wilt in Mauritius. By W. F. Jepson and P. O. Wiehe. *Bull. No.* 47, *Dep. Agric. Mauritius.* Pp. 15, 9¾ × 6. (Port Louis: Government Printer, 1939.) Price 25 cents.

The Pomegranate Fruit Butterfly *Virachola livia* Klug. Morphology, Life-history and Control. By A. D. Hanna. *Bull. No.* 186, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Pp. 54 + 5 plates, 10½ × 7½. (Bulâq, Cairo: Publications Office, Government Press, 1939.) Price P.T.10.

A New Pest of Raspberry in New Zealand (*Priophorus tener* Zaddach). By F. J. Jeffreys. *N.Z. J. Sci. Tech.*, 1939, **21**, 107A-113A.

Experiment in the Growing of Tomatoes [in Barbados] and Shipment to Canada. By A. E. S. McIntosh. *Agric. J. Barbados*, 1938, **7**, 123-138.

Tomato Diseases and Their Control. By S. Fish. *J. Dep. Agric. Vict.*, 1939, **37**, 378-391.

Nailhead Spot of Tomato. Caused by *Alternaria tomato* (Cke.) n. comb. By G. F. Weber. *Bull.* 332, *Fla. Agric. Exp. Sta.* Pp. 54, 9 × 6. (Gainesville, Florida: Agricultural Experiment Station, 1939.)

Spices

Cardamoms. Pocket-lens Studies of Fruit and Seed. By J. Small. *Food*, 1939, **8**, 474-477.

Chillies. *Trop. Agric., Ceylon*, 1939, **93**, 33-36. Deals with the cost of cultivating chillies in Ceylon.

Notizie su la Coltura del Pepe. By E. Suckert. *Agricoltura Colon.*, 1939, **33**, 438-445. Notes on the cultivation of the pepper plant.

Vegetables

Canning Peas in Wisconsin. *Bull. No.* 444, *Wis. Agric. Exp. Sta.* Pp. 24, 9 × 6. (Madison: Agricultural Experiment Station, 1939.)

Effect of Storage, Bulb Size, Spacing and Time of Planting on Production of Onion Seed. By H. A. Jones and S. L. Emsweller. *Bull. No.* 628, *Calif. Agric. Exp. Sta.* Pp. 14, 9 × 6. (Berkeley, Calif.: Agricultural Experiment Station, 1939.)

Diamond-back Moth Investigation in New Zealand. By P. L. Robertson. *Bull. No.* 78, *Dep. Sci. Industr. Res. N.Z.* Pp. 35, 9½ × 6. (Wellington, N.Z.: Government Printer, 1939.) A study of *Plutella maculipennis*, a pest of cabbages and other cruciferous crops.

Fodders and Forage Crops

Feedstuffs in the United Kingdom. A Survey by Canadian Trade Commissioners in the United Kingdom. *Comm. Intell. J., Canada*, 1939, **61**, 1-12, 58-71, 108-117, 157-167. An account of the various feeding stuffs used, the extent of the market, and the organisation of the trade.

Propagation of Cuttings of Herbage Plants by means of Growth-promoting Substances. By J. Scholz and B. Smidrkal. *Herb. Rev.*, 1939, **7**, 176-180.

Grasses of the Hawaiian Ranges. By L. D. Whitney, E. Y. Hosaka and J. C. Ripperton. *Bull. No.* 82, *Hawaii Agric. Exp. Sta.* Pp. 148, 9 × 6. (Honolulu: Agricultural Experiment Station, 1939.)

The Grasslands of the Falkland Islands. By W. Davies. Pp. 86, 9½ × 6. (Stanley, Falkland Islands: Government Printer, 1939.) Price 5*s*.

The Response of Permanent Grassland to Nitrogen and the Efficiency of its Recovery. By H. W. Gardner. *J. Agric. Sci.*, 1939, **29**, 364-378.

Wireworms and the Breaking up of Grass Land. By H. W. Miles. *J. Minist. Agric.*, 1939, **46**, 480-488.

Fodder Conservation with special reference to Grass Drying. A Report prepared for the Committee on the Preservation of Grass and other Fodder Crops, Agricultural Research Council. By E. J. Roberts. *A.R.C. Rep. Ser. No.* 5, 1939. Pp. 137, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 2*s*.

Phalaris tuberosa. Toowoomba Canary Grass. By H. G. Elliott. *J. Dep. Agric. W. Aust.*, 1939, **16**, 161-164.

Tangier Pea (*Lathyrus tingitanus* L.). By G. K. Baron Hay and H. G. Elliott. *J. Dep. Agric. W. Aust.*, 1939, **16**, 165-170.

Barrel Medic (*Medicago tribuloides* Desr.) as a Pasture Legume. By H. C. Trumble. *J. Dep. Agric. S. Aust.*, 1939, **42**, 953-958.

Fertilizer Experiments on Berseem, Season 1937-38. *Agric. Suppl. No.* 44, *Palestine Gaz.*, 1939, 158-163.

Strawberry Clover (*Trifolium fragiferum*). By E. A. Hollowell. *Leafl. No.* 176, *U.S. Dep. Agric.* Pp. 8, 9 × 6. (Washington, D.C.: Superintendent of Documents, 1939.) Price 5 cents.

The Composition and Digestibility, when fed to Pigs and Sheep, of Potato Cossettes and Potato Meal. By H. E. Woodman and R. E. Evans. *J. Agric. Sci.*, 1939, **29**, 347-363.

Silo Types and Construction. By J. R. McCalmont. *Frms'. Bull. No.* 1820, *U.S. Dep. Agric.* Pp. 62, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Making Silage without Expensive Buildings. *Adv. Leafl. No.* 243 (*Revised*), *Minist. Agric. Lond.* Pp. 4, 8½ × 5½. (London: H.M. Stationery Office, 1939.) Price 1*d.*

The Inkberry Plant (*Cestrum lævigatum*), with special reference to its Toxicity. *Frmg. S. Afr.*, 1939, **14,** 352-353, 354.

Oils and Oil Seeds

Report and Accounts of the Coconut Research Scheme, Ceylon, for 1938. Pp. 22, 9¾ × 6. (Colombo: Ceylon Government Press, 1939.)

Studies on the Coconut Palm Beetle (*Oryctes rhinoceros* Linn.) in South India. By M. C. Cherian and K. P. Anantanarayanan. *Indian J. Agric. Sci.*, 1939, **9,** 541-559.

Observations on Olives and Olive Products in Egypt and Italy. By W. V. Cruess. *Fruit Prod. J.*, 1939, **19,** 11-16, 25, 27, 28.

Changes in Olive Composition during Processing. By W. V. Cruess, A. El Saifi and E. Develter. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31,** 1012-1014.

A Discussion of Some of the Physical and Chemical Constants of Olive Oil from Olives at different Stages of Maturity, of different Varieties and from different Localities. A Progress Report. By P. F. Nichols and H. Friar. *Fruit Prod. J.*, 1939, **18,** No. 12, 361-364, 375.

Soya Beans. By M. A. Black. *N.Z. J. Sci. Tech.*, 1939, **21,** 46A-59A. A general article on the cultivation, production and uses of soya beans, with reasons why the crop cannot be recommended for New Zealand under existing conditions.

The Tung Oil Trees (*Aleurites*) and the Tung Oil Industry throughout the World. Pp. 237, 9½ × 6¾. (Rome: International Institute of Agriculture, 1938.) Price 20 Le. The monograph is divided into four sections: (1) cultivation of *Aleurites*, (2) present state of *Aleurites* in the different producing countries, (3) technological study of the Chinese wood oils, (4) trade in Chinese wood oils.

British Standard Specification for Cod Oil for Sulphonation Purposes. *Brit. Stand. Inst. No.* 868, 1939. Pp. 13, 8½ × 5½. (London: British Standards Institution, 1939.) Price 2*s.*

Carnauba Wax. By J. T. Connolly. *Soap*, 1939, **15,** No. 8, 111-113.

Essential Oils

De Beteekenis van de Exploitatie van Rozenhoutolie, afkomstig van *Aniba rosædora* Ducke. By J. W. Gonggrijp. *Ber. No.* 138, *HandMus. Kolon. Inst. Amst.* Pp. 12, 8½ × 5½. (Amsterdam: Koloniaal Instituut, 1939.) The importance of the production of linaloe oil from *Aniba rosædora*. With a summary in English.

Oil of Lemongrass. A Survey of Production, Costs, Marketing and Quality Factors in the Producing Areas. By E. Guenther. *Soap*, 1939, **15,** No. 7, 26-29; No. 8, 28-31, 69.

L'Essence de Rose. By A. Rolet. *Parfum. Mod.*, 1939, **33,** 301-304. Methods of extraction, characteristics and composition of the essential oil.

A Note on the Control and Eradication of New Outbreaks of the Spike Disease of Sandal (*Santalum album*). By Rao Sahib S. Rangaswami and A. L. Griffith. *Indian For. Rec.* (*New Series*) *Silvic.*, **3,** No. 7. Pp. 28, 9¾ × 7¼. (Delhi: Manager of Publications, 1939.) Re. 1 As.6.

Fibres

Industrial Fibres. A Summary of Figures of Production, Trade and Consumption relating to Cotton, Wool, Mohair, Silk, Flax, Hemp, Jute, Coir and Rayon. 1938. *Publication of the Imperial Economic Committee.* Pp. 128, $9\frac{1}{2} \times 7\frac{1}{4}$. (London: H.M. Stationery Office, 1939.) Price 2*s.* 9*d.*

Botanical Survey of India. Catalogue of Fibre Plant Exhibits in the Industrial Section of the Indian Museum. By S. N. Bal. Pp. 40, $9\frac{1}{2} \times 6\frac{1}{4}$. (Delhi: Manager of Publications, 1939.) Price Re. 1 As. 14.

Untersuchungen über den Fasergehalt verschiedener Pflanzen. By G. Bredemann. *Faserforsch.*, 1939, **14**, 105-112. Gives a list of the fibre content of some ninety plants.

Microscopic Methods in Identifying Fibres. *Text. Manuf.*, 1939, **65**, 317-319.

Production and Spinning of "Natural" Unretted Flax. *Irish Text. J.*, 1939, **5**, No. 8, 10-11. A description of the Dodd-Gillespie patent installation at Dromara.

A Preliminary Investigation of the Losses of the Constituents of Flax Straw during Water Retting. By J. F. Couchman. *J. Coun. Sci. Industr. Res. N.Z.*, 1939, **12**, 183-190.

Papers Prepared for Special Sessions on Jute at the British Association Meeting, Dundee, 1939. (1) The Science of Jute. By S. G. Barker. (2) Chemistry in the Processing of Jute. By H. L. Parsons. (3) The Dyeing of Jute. By D. Carter. (4) Rot-proofing of Jute. By H. A. Elkin and W. A. S. White. (5) The Production of Jute. By R. S. Finlow. (6) Some Economic Problems of the Jute Industry. By J. K. Eastham. *J. Text. Inst.*, 1939, **30**, P273-P378.

The Root System of Sisal in Some East African Soils. By J. Glover. *E. Afr. Agric. J.*, 1939, **5**, 18-22.

Paper-making Materials

Pulp and Paper Making as a South African Industry. By P. J. A. Loseby. *J. S. Afr. For. Assoc.*, 1939, No. 2, 56-69.

Les Pâtes à Papier Coloniales. *Bull. Inst. Colon. Havre*, 1939, **11**, No. 116, 12-19. A review of the position with regard to the production of paper pulp in the French Colonies.

Written and Oral Evidence recorded during Enquiry by the Indian Tariff Board into the Paper and Paper Pulp Industries. Volume I. Pp. 600, $9\frac{1}{2} \times 6\frac{1}{4}$. (Delhi: Manager of Publications, 1939.) Price Rs. 5.

Rubber

Administration Report of the Rubber Controller, Ceylon, for the Fifth Year of Control, January 1 to December 31, 1938. Pp. 40, $9\frac{1}{2} \times 6$. (Colombo: Government Record Office, 1939.) Price 50 cents.

Report on the Working of Rubber Regulation in Malaya during 1938. Pp. 32, 13×8. (Kuala Lumpur: Government Press, 1939.)

The Description and Lay-out of [Rubber] Seed Gardens. By C. C. T. Sharp. *Circ. No.* 6, *Rubb. Res. Inst. Malaya.* Pp. 4, 13×8. (Kuala Lumpur: Rubber Research Institute, 1939.)

Bud-grafting. Practical Instructions for Bud-grafting Rubber Trees. *Plant. Manual No.* 8, *Rubb. Res. Inst. Malaya.* Pp. 61, $9\frac{3}{4} \times 6$. (Kuala Lumpur: Rubber Research Institute, 1939.) Price 50 cents. In English, Malay, Chinese, and Tamil.

La Fabrication du Caoutchouc homogénéisé et amélioré dans les Plantations d'Hévéa. By M. Bocquet. *Rev. Bot. Appl.*, 1939, **19**, No. 216, 578-581.

Die Rindenbräune von *Hevea brasiliensis*. By C. A. Gehlsen. *Tropenpflanzer*, 1939, **42**, 323-329. Notes on brown bast disease of rubber.

Tobacco

Tobacco. *Markets Sect. Surv. No.* 1, *Dep. Agric. Burma*. Pp. 41, 9¾ × 6¼. (Rangoon: Superintendent, Government Printing and Stationery, 1939.) Price As. 10. A survey of tobacco in Burma, its cultivation and curing, and the position with regard to imports and exports.

La Culture du Tabac en Haiti. By M. G. Heraux. *Rev. Int. Prod. Colon.*, 1939, Nos. 162-163, 217-226.

Report of a Commission appointed to enquire into the Tobacco Industry of Nyasaland. Pp. 35, 13 × 8. (Zomba: Government Printer, 1939.) Price 1*s*.

The Maintenance of Fertility on Tobacco Estates in North Eastern Rhodesia. By R. H. Fraser. *E. Afr. Agric. J.*, 1939, **5**, 13-17.

The Tobacco Budworm (*Heliothis virescens*) and its Control in the Georgia and Florida Tobacco-growing Region. By A. C. Morgan and F. S. Chamberlin. *Frms'. Bull. No.* 1531 (*Revised*), *U.S. Dep. Agric.* Pp. 9, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Drugs

Ricerche Sperimentali su Alcune Droghe Medicinali dell' Impero. 2. Le Essenze di *Carum copticum* Benth. dell' A.O.I. By P. Rovesti and F. Veneziani. *Riv. Ital. Essenze*, 1939, **21**, 348-354. Notes on the cultivation of *C. copticum* in Abyssinia and the production of the oil.

Market for Cinchona Bark. *Ceylon Tr. J.*, 1939, **4**, 291-292.

Sur le *Pseudocinchona africana* A. Chev., sa Composition chimique et son Utilisation en Thérapeutique. By M. Raymond-Hamet. *Rev. Bot. Appl.*, 1939, **19**, No. 216, 564-569.

Indian Ephedras. *Chem. and Drugg.*, 1939, **131**, 70-72. Notes on the different varieties of Indian ephedras, the extraction of ephedrine and trade in the product.

The Nature of Papain. By C. V. Ganapathy and B. N. Sastri. *Biochem. J.*, 1939, **33**, 1175-1179.

Miscellaneous Agricultural Products

Anhydrous Alcohol in Brazil. *Int. Sug. J.*, 1939, **41**, 352-355. An account of the production of power alcohol from molasses in Brazil.

Charcoal Burning in Small Portable Kilns. By G. H. Donald. *Emp. For. J.*, 1939, **18**, 95-100.

Charcoal Gas Units give Satisfaction on Wheat Farms. By E. C. Powell. *Agric. Gaz. N.S.W.*, 1939, **50**, 473-476. Notes on the costs of charcoal gas fuel for farm machinery.

Cottonseed Hulls as an Industrial Raw Material. By D. M. Musser and R. F. Nickerson. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 1229-1233.

Le Henné dans le Monde Musulman. By F. Scarone. *Agron. Colon.*, 1939, **28**, 79-107, 129-140. The distribution, cultivation and uses of henna in the Mohammedan countries.

Hop Drying. By A. H. Burgess. *J. Minist. Agric.*, 1939, **46**, 524-531.

A Trial of New Varieties of Hops for New York. By J. D. Harlan. *Bull. No.* 687, *N.Y. Agric. Exp. Sta.* Pp. 8, 9 × 6. (Geneva, N.Y.: Agricultural Experiment Station, 1939.).

Livestock and Animal Products

Report on the Department of Animal Health, Gold Coast, for the year 1938-39. Pp. 26, 13 × 8½. (Accra: Publications Branch, Government Printing Department, 1939.) Price 2*s*.

Annual Report on the Veterinary Department, Nigeria, for 1937. Pp. 48, 13½ × 8. (Lagos: Government Printer, 1939.) Price 4*s*.

Annual Report of the Veterinary Department, Northern Rhodesia, for the year 1938. Pp. 60, 13½ × 8. (Lusaka: Government Printer, 1939.) Price 2*s*. 6*d*.

Experiments in Breeding Holstein-Friesian Cattle for Milk- and Butterfat-producing Ability, and an Analysis of the Foundation Cows and of the First Outbred Generation. By M. H. Fohrman and R. R. Graves. *Tech. Bull. No.* 677, *U.S. Dep. Agric.* Pp. 81, 9 × 6 (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 15 cents.

Work of the International Institute of Agriculture regarding Livestock during the last ten years. By G. Ray and E. Moskovitz. *Int. Rev. Agric.*, 1939, **30,** 331T-341T.

Feeding Standards for Farm Animals: V. The Mineral Requirements. By N. C. Wright. *J. Minist. Agric.*, 1939, **46,** 473-479.

Feeding Standards for Farm Animals: VI. The Vitamin Requirements. By N. C. Wright and J. A. B. Smith. *J. Minist. Agric.*, 1939, **46,** 559-565.

A Suspected Mineral Deficiency amongst Cattle in Uganda. By R. N. T. W. Fiennes. *E. Afr. Agric. J.*, 1939, **5,** 68-70.

Gli Ovini Karakul in Tripolitania. Risultati del 1° Triennio di Allevamento (1934-37). By E. Ducros. *Ann. Cent. Sper. Agr. Zoo., Libia*, 1938, **1,** 13-21.

Sheep Rugging Experiment. By I. Thomas and G. L. Throssell. *J. Dep. Agric. W. Aust.*, 1939, **16,** 148-151.

Dairy Supplies, 1938, including Poultry and Pig Products. *Publication of the Imperial Economic Committee.* Pp. 123, 13 × 8. (London: H.M. Stationery Office, 1939.) Price 2*s*. 6*d*.

Present Position of the Dairying Industry in the Different Countries. No. 21. Greece. By E. Gasser. *Int. Rev. Agric.*, 1939, **30,** 342T-350T.

Parasites of Poultry. By F. H. S. Roberts. *Queensld. Agric. J.*, 1939, **52,** 4-26.

Turkey Production in California. By V. S. Asmundson and T. H. Jukes. *Circ. No.* 110, *Calif. Agric. Ext. Serv.* Pp. 78, 9 × 6. (Berkeley, Calif.: College of Agriculture, 1939.)

The Transport of Hatching Eggs from Great Britain to Ceylon by Air Mail. By M. Crawford. *Trop. Agric., Ceylon*, 1939, **93,** 27-29.

Administration Report of the Madras Fisheries Department for 1937-38. Pp. 81, 9½ × 6. (Madras: Superintendent, Government Press, 1939.) Price As. 8.

Report on the Fisheries of New South Wales for the year 1936 and the six months ended 30th June, 1937. Pp. 21, 13 × 8½. (Sydney: Government Printer, 1939.)

Report of the United States Commissioner of Fisheries for 1937. Pp. 461, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Arranged in five sections as follows: Bureau of Fisheries; Fishery Industries of the United States, 1936; Alaska Fishery and Fur-Seal Industries in 1936; Progress in Biological Inquiries, 1936; and Propagation and Distribution of Food Fishes, 1937.

Ranch-bred Furs in the United Kingdom Market. A Survey by the Canadian Trade Commissioners in London and Oslo in collaboration with the Fur Trade Adviser in London of the Department of Agriculture. *Comm. Intell. J., Canada*, 1939, **61,** 209-223.

FORESTRY

General

Annual Report of the Forestry Commissioners for the year ending September 30, 1938. Pp. 61, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 1*s*.

Native Housing in Relation to Forestry in the Anglo-Egyptian Sudan with Details of Types of Houses for which Local Sawn Timber Output has been Standardised. By J. Smith and A. M. Petrie. *Pap. No.* 20, *Imp. For. Inst. Oxford.* Pp. 19, 9½ × 6. (Oxford: Imperial Forestry Institute, 1939.) Price 2*s*.

Report on Forest Administration in the Jammu and Kashmir State for the year 1937-38. Pp. 40, 7 × 10. (Jammu: Government Press, 1939.)

Report of the Forestry Department of the Madras Presidency for the year ending March 31, 1938. Pp. 101, 9¾ × 6. (Madras: Superintendent, Government Press, 1939.)

Report on Forest Administration in Mysore State for the year ended June 30, 1938, with the Government Review thereon. Pp. 235, 10 × 6. (Bangalore: Government Press, 1939.)

Annual Report of the Forest Department, Kenya Colony, for 1938. Pp. 35, 9¾ × 6. (Nairobi: Government Printer, 1939.) Price 1*s*.

The Woody Vegetation of the Coast Province of Kenya. By I. R. Dale. With an Appendix of Additions and Corrections to the "Trees and Shrubs of Kenya Colony" (1936). *Pap. No.* 18, *Imp. For. Inst. Oxford.* Pp. 28, 9½ × 6. (Oxford: Imperial Forestry Institute, 1939.) Price 2*s*.

Annual Report on Forest Administration in Malaya, including Brunei, for the year 1938. Pp. 87, 9½ × 6. (Kuala Lumpur: Government Printer, 1939.) Price 1*s*. 4*d*.

Annual Report of the Director of Forestry, State Forest Service, New Zealand, for the year ended March 31, 1939. Pp. 37, 13½ × 8½. (Wellington, N.Z.: Government Printer, 1939.)

Annual Report on Forest Administration of Nigeria for the year 1938. Pp. 14, 13½ × 8. (Lagos: Government Printer, 1939.) Price 1*s*. 6*d*.

Administration Report of the Conservator of Forests, Trinidad and Tobago, for the year 1938. Pp. 16 + map, 13 × 8. (Port of Spain: Government Printer, 1939.) Price 18 cents.

Die Forstwirtschaft Südafrikas. Ein Beispiel für grosszügigen forstwirtschaftlichen Aufbau. By R. D. Hartig. *Z. Weltforstw.*, 1939, **6**, 661-748. A comprehensive study of forestry in South Africa.

Thinning, Pruning and Management Studies on the Main Exotic Conifers grown in South Africa. By I. J. Craib. *Sci. Bull. No.* 196, *Dep. Agric. Un. S. Afr.* Pp. 179, 9½ × 6. (Pretoria: Government Printer, 1939.) Price 1*s*.

The Recording of Structure, Life-form and Flora of Tropical Forest Communities as a Basis for their Classification. By P. W. Richards, A. G. Tansley and A. S. Watt. *Pap. No.* 19, *Imp. For. Inst., Oxford.* Pp. 19, 9½ × 6. (Oxford: Imperial Forestry Institute, 1939.) Price 1*s*.

The Formation of Growth Rings in Indian Trees. Part I. (*a*) Chir (*Pinus longifolia*), (*b*) Cutch (*Acacia catechu*), (*c*) Jaman (*Eugenia jambolana*), (*d*) Laurel (*Terminalia tomentosa*), (*e*) Sal (*Shorea robusta*), (*f*) Semul (*Bombax malabaricum*), (*g*) Teak (*Tectona grandis*). By K. Ahmad Chowdhury. *Indian For. Rec.* (*New Series*), *Util.*, 1939, **2**, No. 1. (Delhi: Manager of Publications, 1939.) Price Rs. 2 As. 2.

Monographie Forestière du *Chlorophora excelsa* Benth. et Hook. By G. Tondeur. *Bull. Agric. Congo Belge*, 1939, **30**, 163-198.

An Investigation into the best Age and Diameter of Stump to use when Stump Planting Teak (*Tectona grandis*) in Areas having a general West Coast Type of Climate. By A. L. Griffith. *Indian For. Rec.* (*New Series*) *Silvic.*, **3**, No. 5. Pp. 30, 9½ × 7¼. (Delhi: Manager of Publications, 1939.) Price Re. 1.

The Black Hills Beetle (*Dendroctonus ponderosæ* Hopk.). A Serious Enemy of Rocky Mountain Pines. By J. A. Beal. *Frms'. Bull. No.* 1824, *U.S. Dep. Agric.* Pp. 21, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Cankerworms. By T. H. Jones. *Leafl. No.* 183, *U.S. Dep. Agric.* Pp. 8, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Elm Bark Beetles. By T. H. Jones. *Leafl. No.* 185, *U.S. Dep. Agric.* Pp. 8, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents. Life-history and control measures are given.

Timber

Rapport sur l'Activité du Comité National des Bois Coloniaux en 1938. Pp. 19, 8½ × 5½. (Paris: Comité National des Bois Coloniaux, 1939.)

A Reconnaissance of the Bending Qualities of Some Australian Timbers. By R. S. T. Kingston. *J. Coun. Sci. Industr. Res. N.Z.*, 1939, **12**, 264-274.

Unidirectional Drying of Wood. By E. Bateman, J. P. Hohf and A. J. Stamm. *Industr. Engng. Chem., Industr. Ed.*, 1939, **31**, 1150-1154.

Identification et Emplois des Bois d'Afzelia. By D. Normand. *Rev. Bot. Appl.*, 1939, **19**, 488-494.

American Southern Cypress. By W. L. Neubrech. *Tr. Prom. Ser. No.* 194, *U.S. Dep. Comm.* Pp. 30, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents. An account of the production and uses of this timber, derived chiefly from *Taxodium distichum*.

American Southern Pine. By W. L. Neubrech. *Tr. Prom. Ser. No.* 191, *U.S. Dep. Comm.* Pp. 36, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents. Deals with the production and uses of the wood of various species of *Pinus* known as Southern Pine.

Slash Pine. By W. R. Mattoon. *Frms.' Bull. No.* 1256 (*Revd.*), *U.S. Dep. Agric.* Pp. 56, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

The Physical and Mechanical Properties of Mountain Hickory (*Acacia penninervis*). By I. Langlands. *J. Coun. Sci. Industr. Res. N.Z.*, 1939, **12**, 277-280.

Gums and Resins

The Practicability of Biological Control in the Lac Industry. By P. M. Glover and S. N. Gupta. *Indian J. Agric. Sci.*, 1939, **9**, 523-530.

Tanning Materials and Hides and Skins

Java Wattle-bast op de Europeesche Markt. By W. Spoon. *Ber. No.* 137, *HandMus. Kolon. Inst. Amst.* Pp. 15, 8½ × 5½. (Amsterdam: Koloniaal Instituut, 1939.) Java wattle bark on the European market. With a summary in English.

A Preliminary Report on Some Aspects of Wattle Pathology. By R. P. Stephens and W. B. Goldschmidt. *J. S. Afr. For. Assoc.*, 1939, No. 2, 31-43.

The Marketing of Hides and Skins in the Union of South Africa. By F. R. Tomlinson. *Bull. No.* 180, *Dep. Agric. Un. S. Afr.* Pp. 25, 9½ × 6. (Pretoria: Government Printer, 1939.) Price 3*d.*

IMPERIAL INSTITUTE

CONSULTATIVE COMMITTEE ON INSECTICIDE MATERIALS OF VEGETABLE ORIGIN

QUARTERLY BIBLIOGRAPHY ON INSECTICIDE MATERIALS OF VEGETABLE ORIGIN, NO. 8

(July to October 1939)

Prepared in collaboration with the Imperial Institute of Entomology and the Department of Insecticides and Fungicides, Rothamsted Experimental Station.

GENERAL

Entoma. A Directory of Insect Pest Control. Ed. by C. C. Hamilton. Third Edition. (New Jersey Agricultural Experiment Station, 1939.) In addition to lists of U.S. firms supplying all requisites for pest control, trade names of products, etc., includes general information on various insecticides and repellents.

Fungicides and Insecticides Sales Reported—Italy. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 25, 410-411. Includes figures of consumption of nicotine, quassia, pyrethrum and rotenone products for the years 1936, 1937 and 1938.

The Trend of Progress—Insecticides. By J. T. Martin and F. Tattersfield. *Chem. and Ind., Lond.*, 1939, **58**, No. 27, 635-640; No. 30, 720-722.

Quelques Plantes Vénéneuses Américaines et Asiatiques aux Propriétés Insecticides. By F. Scarone. *Agron. Colon.*, 1939, **28**, No. 257, 174-184. This first instalment of the article contains brief notes on some thirty species of plants of America and Asia having insecticidal properties and includes *Derris*, *Nicotiana*, *Mundulea*, *Anamirta*, *Lonchocarpus*, *Tephrosia*, *Sapindus* and *Paullinia*.

Biological Methods of Testing Insecticides. A Review. By F. Tattersfield. Pp. 20, 10 × 7. (Harpenden, Herts.: Rothamsted Experimental Station, 1939.) Reprinted from *Ann. Appl. Biol.*, 1939, **26**, 365-384.

Chemical Investigations on Insecticidal Plants (Tobacco, Derris, Pyrethrum, etc.) and their Constituents. *Rep. Bur. Ent. U.S. Dep. Agric.*, 1938, 67.

The Use of Chemical Potentials as Indices of Toxicity. By J. Ferguson. *Proc. Roy. Soc.*, 1939, B, **127**, No. 848, 387.

Laboratory Spraying and Washing Apparatus. By D. Chisholm ET 149, 1939, *U.S. Dep. Agric.*

Tests on Crawling Insects. Tentative methods for evaluating liquid household insecticides against the German cockroach and th

bedbug. By E. N. Woodbury and C. S. Barmhart. *Soap*, 1939, **15**, No. 9, 93-107, 113.

The Toxicity of Poisons Applied Jointly. By C. I. Bliss. *Ann. Appl. Biol.*, 1939, **26**, No. 3, 585.

Biostatistical Problems involved in the Standardisation of Liquid Household Insecticides. By F. L. Campbell, G. W. Snedecor and W. A. Simanton. *J. Amer. Statist. Ass.*, 1939, **34**, 62-70.

The Case for Deodorized Insecticide Oils. By A. B. Weingard. *Soap*, 1939, **15**, No. 9, 109, 113.

Concentrated Mixtures for Aerial Spraying. By S. F. Potts. *J. Econ. Ent.*, 1939, **32**, No. 4, 576-580. Discusses the relative merits of various sprays including nicotine, pyrethrum and derris.

Spraying Woodlands with an Autogiro for Control of the Gypsy Moth. By S. F. Potts. *J. Econ. Ent.*, 1939, **32**, No. 3, 381-387.

Report Connecticut State Entomologist, 1937. *Bull.* 408 (1938), *Conn. Agric. Exp. Sta.* Includes brief reference to control of European corn borer by nicotine tannate and cube; of onion thrips by cube and nicotine sulphate; of oriental fruit moth by cube and nicotine tannate; of squash bug by nicotine compounds, anabasine sulphate and pyrethrum; etc.

Control of Truck Crop Aphids. By H. G. Walker and L. D. Anderson. *J. Econ. Ent.*, 1939, **32**, No. 4, 498-505. A summary of the results of experiments conducted at the Virginia Truck Experiment Station on several species of aphids using nicotine, cube and derris in various forms.

Lygus hesperus Knight and *Lygus elisus* Van Duzee in relation to Alfalfa Seed Production. *Bull.* 284 (1939), *Utah Agric. Exp. Sta.* Includes tests with pyrethrum and nicotine sulphate. (*R.A.E.*, 1939, **27**, A, Pt. 9, 462.)

Studies on Pea Aphid Control. By L. P. Ditman, E. N. Cory and C. Graham. *J. Econ. Ent.*, 1939, **32**, No. 4, 537-546. Includes experiments with derris, cube and other proprietary rotenone-containing insecticides.

Field Tests on Control of the Pea Aphid *Illinoia pisi* Kltb. By C. Graham and E. N. Cory. *J. Econ. Ent.*, 1939, **32**, No. 4, 574-576. Gives the results of a number of experiments on the use of nicotine, derris, cube and proprietary rotenone-containing insecticides.

Work on Insecticides against the Cabbage White Butterfly *Pieris rapae* L. By W. Collier. *N.Z. J. Sci. Tech.*, 1939, **21**, 23A-45A. A record of experiments conducted with a number of insecticides, including derris, pyrethrum and nicotine.

Investigations of Insecticides for Control of the European Corn Borer at Toledo, Ohio, 1937-1938. By W. A. Baker and D. D. Questel. *J. Econ. Ent.*, 1939, **32**, No. 4, 526-530. Includes tests with derris, nicotine and quebracho-nicotine-tannate paste.

Report of Tobacco Substation at Windsor, Connecticut, 1937. *Bull.* 410 (1938), *Conn. Agric. Exp. Sta.* Includes brief reference to control of tobacco thrips by nicotine sulphate and cube; and of wireworms by cube and pyrethrum.

The Japanese Beetle in Connecticut. By W. E. Britton and J. P. Johnson. *Bull.* 411 (1938), *Conn. Agric. Exp. Sta.* Includes reference to control by derris and pyrethrum.

Some Mealy Bugs of Egypt and Experiments on their Control by means of Chemicals. By M. Beshir and M. Hosny. *Bull. No.* 209, *Tech. and Sci. Serv., Minist. Agric. Egypt.* Reference made to the use of nicotine sulphate and pyrethrum in these experiments.

The Chemical Control of Insect Pests of Animals. By J. Hendrick and W. Moore. *Trans. Highland Agric. Soc., Scotland*, 1939, **51**, 58-74. Includes use of pyrethrum, derris, pine oil and synthetics.

Krátké zprávy (Short notes). *Ochr. Rost.*, 1939, **15**, 51-56. Includes tests with nicotine sulphate on poppy weevil (*Ceuthorrhynchus macula-alba* Hbst.); derris and pyrethrum on greenhouse whitefly (*Trialeuroides vaporariorum* Westw.); and derris on *Aphis gossypii* Glov. (*R.A.E.*, 1939, **27**, A, Pt. 9, 470.)

The Carrot Rust Fly. By W. D. Whitcomb. *Bull.* 352 (1938), *Mass. Agric. Exp. Sta.* Includes tests with derris, cube and pyrethrum against *Psila rosae* F. (*R.A.E.*, 1939, **27**, A, Pt. 9, 496.)

Report, Division of Entomology, Washington Agricultural Experiment Station, 1937-38. *Bull.* 368 (1938). Includes tests of nicotine sulphate against codling moth and of derris, pyrethrum and nicotine sulphate against onion thrips. (*R.A.E.*, 1939, **27**, A, Pt. 10, 525.)

Diptera as Pests of Agricultural Plants. I. (In Japanese.) By R. Nozu. *J. Plant Prot. Tokyo*, 1939, **26**, No. 7, 482-491. Includes reference to nicotine sulphate and derris in the control of *Chloropisca notata* Mg., a pest of cereals. (*R.A.E.*, 1939, **27**, A, Pt. 10, 556.)

Entomological Progress. *Bull.* 298 (1938), *La. Agric. Exp. Sta.* Contains results of tests of nicotine and derris dusts on *Rhopalasiphum pseudobrassicae* Davis on turnip; of derris dust on flea-beetle (*Phyllotreta vittata discedens* Weise); and of derris and pyrethrum dusts on sweet-potato weevil. (*R.A.E.*, 1939, **27**, A, Pt. 7, 370.)

Diseases, Insects and other Pests Injurious to Plants. *Bienn. Rep. Kans. Agric. Exp. Sta.*, 1936-38. Includes tests of nicotine sulphate and pyrethrum sprays and of pyrethrum and rotenone dusts on *Ancylis comptana* Froel., a pest of strawberries. (*R.A.E.*, 1939, **27**, A, Pt. 7, 375.)

Results of Researches in Strawberry Growing. By W. S. Rogers, M. E. King and A. M. Massee. *Sci. Hort.*, 1939, **7**, 71-84. Contains reference to control of strawberry aphids by nicotine sprays and dusts, derris sprays and dusts and atomised pyrethrum spray. (*R.A.E.*, 1939, **27**, A, Pt. 8, 395.)

The European Red Mite and its Control. By P. Garman and J. F. Townsend. *Bull.* 418 (1938), *Conn. Agric. Exp. Sta.* Includes tests with nicotine sulphate and derris and cube sprays. (*R.A.E.*, 1939, **27**, A, Pt. 8, 429.)

Caterpillars attacking Tomatoes. By A. E. Michelbacher and E. O. Essig. *Bull.* 625 (1938), *Calif. Agric. Exp. Sta.* Mixtures of pyrethrum and derris with sulphur on *Heliothis armigera* Hb. gave no control. (*R.A.E.*, 1939, **27**, A, Pt. 8, 431.)

ALKALOID-CONTAINING MATERIALS

Tobacco Products, including Nicotine and Nicotine Derivatives

Tobacco Exports from the United States, first 6 months of specified year. *Tobacco Markets, U.S. Dep. Comm.*, 1939, **14**, No. 30, 366. Gives exports of nicotine and tobacco extract for first six months of 1937, 1938 and 1939.

Nicotine Factory Proposed—Yugoslavia. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 29, 475.

Über die Verteilung des Nicotins in der Tabakpflanze. By J. Andreadis and E. Toote. *Chem. Zentr.*, 1939, **110**, No. 21, 4261. Abstract of paper in *Z. Unters. Lebensmittel*, 1939, **77**, 262. Relates to the distribution of nicotine in the different parts of the tobacco plant.

The Effect of Light and Soil Nutrition Factors upon Nicotine Accumulation in *Nicotiana rustica* Plants. By V. A. Dovgan. *Bull. No.* 138, *All Union Sci. Res. Inst., Tobacco and Makhorka* (*V.I.T.I.M.*), 93-107. In Russian with brief summary in English.

Chemical Investigations of the Tobacco Plant. VII. Chemical Changes that Occur in Stalks during Culture in Light and in Darkness. By H. B. Vickery and others. *Bull.* 407 (1938), *Conn. Agric. Exp. Sta.*

Aprovechamiento de los Subproductos del Tabaco. By C. Rein. *Rev. Agricol., Guatemala,* 1938, **16,** Nos. 2-4, 52-55. Brief account of the manufacture of nicotine products and their use.

Silicotungstic Acid Determination of Nicotine. Errors Involved and a New Technique for Steam Distillation of Nicotine. By A. W. Avens and G. W. Pearce. *Industr. Engng. Chem., Anal. Ed.,* 1939, **31,** 505-508.

Agar-Agar, a New Activator for Nicotine Sprays. By S. S. Sharp. *J. Econ. Ent.,* 1939, **32,** No. 3, 394-395.

Parasiticide Suitable for Use on Plants. E. W. Bousquet. Sulphurised nicotine. U.S. Pat. No. 2165030. *Amer. Chem. Absts.,* 1939, **33,** 8351.

The Removal of Nicotine Spray Residues from Apples. By J. F. Cassidy. *J. Econ. Ent.,* 1939, **32,** No. 4, 598.

The Photometric Determination of Nicotine on Apples, without Distillation. By L. N. Markwood. *J. Ass. Off. Agric. Chem., Wash.,* 1939, **22,** 427-436.

Combined Washes. Progress Report—V. By H. G. H. Kearns and H. Martin. *Ann. Rept. Agric. Hort. Res. Sta. Long Ashton, Bristol,* 1938, 66-71. Includes tests with nicotine-petroleum wash.

Entomological Problems. *12th Rep. Coun. Sci. Industr. Res. Aust.,* 1937-38. Includes reference to nicotine-bentonite sprays. (*R.A.E.,* 1939, **27,** A, Pt. 10, 544.)

Vergleichende biochemische und chemische Versuche mit Mineralölemulsion, Nikotin und Kaliseife gegen Blattläuse. (Comparative biochemical and chemical experiments with mineral oil emulsion, nicotine and potash soap against aphids.) *Z. Pflkrankh.,* 1939, **49,** Pt. 4, 276-281. (*R.A.E.,* 1939, **27,** A, Pt. 9, 458.)

Control of the Rosy Apple Aphid in Connecticut Apple Orchards. By P. Garman. *Circ.* 126 (1938), *Conn. Agric. Exp. Sta.* Includes tests with nicotine preparations. (*R.A.E.,* 1939, **27,** A, Pt. 8, 428.)

Codling Moth Control. Successful Use of Nicotine Insecticides. *Chem. Tr. J.,* 1939, **105,** No. 2723, 84.

The Effects of Neutral Copper Fungicides on Tank-Mix Nicotine-Bentonite in Control of the Codling Moth. By L. F. Steiner and J. E. Fahey. *J. Econ. Ent.,* 1939, **32,** No. 3, 365-369.

Codling Moth Insecticide Investigations in 1938 at the Vincennes Laboratory. By L. F. Steiner, J. E. Fahey and S. A. Sumerland. *Trans. Indiana Hort. Soc.,* 1938, 86-99. Tank mixture of nicotine sulphate, bentonite, soybean oil, sodium lauryl sulphate.

The Elm Leaf Beetle. By C. W. Collins. *Leafl.* 184 (1939), *U.S. Dep. Agric.* Control by nicotine sprays.

Experiments with Quebracho-fixed Nicotine for the Control of the European Corn Borer. By C. H. Batchelder. *J. Econ. Ent.,* 1939, **32,** No. 4, 513-516.

The Oriental Peach Moth (*Cydia molesta* Busck.). Investigations in the Goulburn Valley, Victoria. Progress Report for the Seasons 1935-38. By G. A. H. Helson. *Pamphl. No.* 88, *Coun. Sci. Industr. Res. Aust.* Use of nicotine sulphate failed to give satisfactory results in the field.

Tobacco Insect, *Dolycoris baccarum* L. By V. Popa. *Amer. Chem. Absts.,* 1939, **33,** 7949. Use of tobacco extract to control.

The Insect *Thrips tabaci.* By V. Ghimpu. *Amer. Chem. Absts.,* 1939, **33,** 7949. Spray of nicotine sulphate recommended to control the insect.

Sprays control Prune Thrips. By S. C. Jones. *Better Fruit*, 1939, **33**, No. 9, 3, 16. Discusses use of sprays containing nicotine sulphate. (*R.A.E.*, 1939, **27**, A, Pt. 9, 498.)

Greenhouse Tomatoes. By J. H. Beattie. *Frms'. Bull.* 1431 (1939), *U.S. Dep. Agric.* Control of white fly and red spider by nicotine.

De draaihartigheid bij kool, III. (Deformed Heart of Cabbage, III.) By S. Leefmans. *Med.* 11 (1939), *Tuinb.- Voorlichtingsdienst, The Hague.* Includes tests of nicotine sprays on *Contarinia nasturtii* Kieffer. (*R.A.E.*, 1939, **27**, A, Pt. 10, 514.)

A New Insect Pest of Chrysanthemum. By W. E. H. Hodson and S. G. Jary. *J. Minist. Agric.*, 1939, **46**, No. 1, 54. Includes test of nicotine wash on *Paraxyna misella* Lw. (*R.A.E.*, 1939, **27**, A, Pt. 10, 519.)

Zur Biologie und Bekämpfung von Knospen-Gallmücken an Rotbuchen. (The biology and control of bud gall-midges on beech.) By H. Fischer. *Arb. physiol. angew. Ent. Berl.*, 1939, **6**, No. 1, 44-51. Control of *Dasyneura fagicola* by tobacco dust and nicotine spray. (*R.A.E.*, 1939, **27**, A, Pt. 7, 353.)

Le Faux-tige des Arbres Fruitiers (*Monosteira unicostata* Muls. et Rey.) au Maroc. By P. Brèmond. *Rev. Path. vég.*, 1938, **25**, fasc. 4, 294-307. Most effective control measure is a nicotine spray. (*R.A.E.*, 1939, **27**, A, Pt. 7, 359.)

Oil Sprays for Deciduous Fruit Trees by the Tank-mixture Method. By A. D. Borden. *Circ.* 345 (1938), *Calif. Agric. Exp. Sta.* Includes use of nicotine sulphate in oil sprays. (*R.A.E.*, 1939, **27**, A, Pt. 8, 432.)

Anabasine

On the Alkaloids in Different Species of Anabasis. By N. G. Prein. *Herb. Abstr.*, 1939, **9**, No. 2, 169.

Others

The Action of certain Assamese Plants as Larvicides. By D. Manson. *J. Malar. Inst. India*, 1939, **2**, No. 1, 85-93. Includes tests on Anopheline larvæ of *Duranta plumieri* berries, the toxic effect of which is due to an alkaloid resembling narcotine. (*R.A.E.*, 1939, **27**, B, Pt. 10, 207.)

Quinine Outlets of Industrial Nature Sought—Netherlands. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, 595. Contains a brief reference to experiments conducted with a view to producing an insecticide from quinine.

The Veratrine Alkaloids. V. The selenium dehydrogenation of cevine. By L. C. Graig and W. A. Jacobs. *J. Biol. Chem.*, 1939, **129**, No. 1, 79.

INSECTICIDE MATERIALS CONTAINING ROTENONE AND ALLIED SUBSTANCES

General

Rotenone Bearing Roots Imports Gaining in United States. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 33, 548. Gives imports into the U.S.A. for 1937, 1938 and first six months of 1939.

Rotenone Plants and Rotenone. By A. Guillaume. *Amer. Chem. Absts.*, 1939, **33**, 7949. Review of the occurrence, properties, insecticidal action and evaluation of rotenone and its preparations.

Annual Report, 1938, East African Agricultural Research Station, Amani. Contains a brief summary of work carried out by R. R. Le G.

Worsley on the distribution of "rotenoids" in species of *Derris*, *Tephrosia* and *Mundulea* and on the determination of rotenone.

Fish Poison Plants. *For. Res. India*, 1937-38, Pt. I, *The Forest Research Institute*, 71-73. Results of preliminary examination for rotenone of a number of Indian fish poisons, including *Tephrosia* spp. and *Derris* sp.

Report of the Puerto Rico Experiment Station, 1937. In addition to cultivation experiments on *Derris*, *Lonchocarpus* and *Tephrosia*, mentioned in Bibliography No. 7, includes investigations on the following rotenone-containing plants: *Calopogonium orthocarpum*, *C. coeruleum*, *Amorpha fruticosa* and *Tephrosia vogelii*. (*R.A.E.*, 1939, **27**, A, Pt. 9, 501.)

Determination of Rotenone in Derris and Cube Powders. Use of Decolorising Carbon in the Chloroform Extraction Method. By J. J. T. Graham. *J. Ass. Off. Agric. Chem., Wash.*, 1939, **22**, 408-411.

Colorimetric Evaluation of Derris and Cube Roots. By H. A. Jones. *Industr. Engng. Chem., Anal. Ed.*, 1939, **11**, 429-431.

L'Appréciation de la Valeur insecticide des Plantes roténonées, d'après le dosage de la roténone. By A. Guillaume and G. Hervé. *Rev. Bot. Appl.*, 1939, **19**, No. 216, 552-564.

A New Solvent for Rotenone Insecticides. *Chem. Tr. J.*, 1939, **105**, No. 2726, 148.

Stabilised Rotenone. *Soap*, 1939, **15**, No. 9, 113. Relates to U.S. Pat. No. 2151651, describing a method of inhibiting the deterioration of rotenone caused by the action of light, by the addition of certain chemicals to the solvent.

Annual Report of the Director, Agricultural Experiment Station, University of Wisconsin, for the year ended June 30, 1938. Includes experiments with rotenone against various pests.

Control of Citrus Red Mite (Spider). By A. M. Boyce and D. T. Prendergast. *Calif. Citrogr.*, 1938, **23**, No. 9, 370, 398-400. Includes tests with rotenone-oil sprays. (*R.A.E.*, 1939, **27**, A, Pt. 9, 459.)

What's New in Farm Science. Part II. Annual Report, Wisonsin Agricultural Experiment Station, 1937-38 (1939). Brief reference to control of cabbage worms and cucumber beetles by rotenone dusts.

Rotenone Series Compounds. A Study of Toxicity to the Housefly of Optically Active and Inactive Compounds of the Rotenone Series. By W. N. Sullivan, L. D. Goodhue and H. L. Haller. *Soap*, 1939, **15**, No. 7, 107, 109, 111, 113.

The Asparagus Beetle in Utah. By G. F. Knowlton. *J. Econ. Ent.*, 1939, **32**, No. 1, 154-155. Control of rotenone dusts and sprays. (*R.A.E.*, 1939, **27**, A, Pt. 8, 426.)

Suggestions for the Control of Sawflies on Conifers. By E. I. McDaniel. *Quart. Bull. Mich. Agric. Exp. Sta.*, 1939, **21**, No. 3, 161-164. Includes tests with rotenone dust. (*R.A.E.*, 1939, **27**, A, Pt. 9, 461.)

Practical Apescts of Pea Aphid Control. By L. P. Ditman. *Trans. Peninsula Hort. Soc.*, 1938, 136-141. Discusses value of derris and cube dusts and sprays against *Macrosiphum onobrychis* Boy. (*R.A.E.*, 1939, **27**, A, Pt. 9, 497.)

Derris

List of Common Names used for species of *Derris* in connection with Insecticidal Properties. By R. C. Roark. E477, 1939, *U.S. Dep. Agric.*

Annual Bulletin of Divisional Reports, 1938, Department of Agriculture, Fiji. Brief note *re* satisfactory progress of experimental plot of *Derris elliptica* in Fiji.

Derris Root Exports Increased—British Malaya. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 27, 442. Figures for 1934 to 1938.

Derris Cultivation Encouraged—Netherlands Indies. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 37, 618.

Derris Cultivation in Java and Sumatra. *Chem. Tr. J.*, 1939, **105**, 284. To be increased in these countries.

Beknopt overzicht van de Ondernemings-cultures in het rayon Zuid-Sumatra gedurende 1938. *Bergcultures*, 1939, **13**, No. 23, 768-782. Contains a note on the planting of *Derris elliptica* between rubber trees in South Sumatra.

Derris Trials in New Guinea. *N. Guinea Agric. Gaz.*, 1939, **5**, No. 2, 14. Reference to efforts being made to encourage the cultivation of the crop.

Tuba (*Derris* spp.) in North Borneo. *Ann. Rep. Dep. Agric. N. Borneo*, 1938, p. 3. Brief note.

Derris Root Exports Lower—Philippine Islands. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 28, 462.

Notes on the Rotenone Content of Cebu Derris. By J. M. Ejercito. *Philipp. J. Agric.*, 1939, **10**, 187-191.

Manurial Trials with Derris. By C. D. V. Georgi, A. B. Lucy and Gunn Lay Teik. *Malay. Agric. J.*, 1939, **27**, No. 6, 222-233.

Preliminary Results of Analysis of Clonal Types of Derris under Field Conditions. By C. D. V. Georgi and Gunn Lay Teik. *Malay. Agric. J.*, 1939, **28**, 302-331. With an appendix on a method for the estimation of rotenone.

The Active Principles of Leguminous Fish-poison Plants. Pt. II. The Isolation of l-Elliptone from *Derris elliptica*. By S. H. Harper. *J. Chem. Soc.*, 1939, July, 1099-1105.

The Active Principles of Leguminous Fish-poison Plants. Part III. The Structure of Elliptone. By S. H. Harper. *J. Chem. Soc.*, 1939, Sept., 1424.

Sumatrol. Part II. The Synthesis of Dehydrotetrahydrosumatrol. By T. S. Kenny, A. Robertson and S. M. George. *J. Chem. Soc.*, 1939, Oct., 1601-1604.

Constituents of Derris Root. II. By T. M. Meyer and D. R. Koolhaas. *Rec. Trav. Chim.*, 1939, **58**, 875-884.

The Constituents of Derris. *Mfg. Chem.*, 1939, **10**, No. 8, 261.

New Activator for Insecticides Boosts " Kill Power," Cuts Costs. *Oil, Paint, Drug Rep.*, 1939, **136**, No. 6, 17-18. *Chem. Tr. J.* 1939, **105**, No. 2726, 148. Relates to the use of a solution of derris extractives (and other insecticide materials) in butyl mesityl oxide oxalate. The solvent itself possesses insecticidal properties.

Investigations on Insect Pests of Brassica Seed Crops in Romney Marsh. By S. G. Jary and M. D. Austen. *J. S.E. Agric. Coll. Wye*, No. 44, July 1939, 73-83. Includes tests of derris dust against *Meligethes æneus* F.

Directe Bestrijding van *Helopeltis* in de Thee-cultuur door middel van Derrispraeparaten. By I. de Haan. *Bergcultures*, 1939, **13**, 1082-1085. Direct combat of Helopeltis in tea cultivation by means of derris preparations.

Verslag van de Excursie naar Megamendoeng ter Bezichtiging van een Helopeltisbestrijdingsproef door middel van Derrispreparaten. By H. W. de Perron. *Bergcultures*, 1939, **13**, 1086. Report on a visit to Megamendoeng in connection with experiments on the control of *Helopeltis* by means of derris preparations.

Greenhouse Tomatoes. By J. H. Beattie. *Frms'. Bull.* 1431 (1939), *U.S. Dep. Agric.* Control of red spider by derris.

Jaarverslag (Annual Report of the Vorstenland Tobacco Experiment Station, Java), 1937-38. *Med.* 87 (1939), *Proefsta. Vorstenb. Tab.*

Includes tests of derris spray against tobacco thrips and reference to a rapid polarimetric method of determining rotenone content of derris powders. (*R.A.E.*, 1939, **27**, A, Pt. 9, 493.)

The Toxicity of Derris to Larvæ of the Citrus Whitefly. By L. L. English. *J. Econ. Ent.*, 1939, **32**, No. 3, 360-363.

Derris as a Toxic Supplement to Oil Emulsions for the Control of Purple Scale. By L. L. English. *J. Econ. Ent.*, 1939, **32**, No. 4, 587-595.

Derris used for Combatting Strawberry Pest in Germany. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 31, 510. A newly-developed insecticide preparation incorporating derris extract reported to be used successfully against the strawberry beetle.

Untersuchungen über den Einfluss von Pflanzenschutzmitteln auf die Bienen. IV. Teil: Die Wirkung von Derris auf die Bienen. (Investigations on the effect on bees of materials used in plant protection work. Part IV. The action of derris on bees.) *Z. angew. Ent.*, 1939, **25**, Pt. 4, 681-702. (*R.A.E.*, 1939, 27, A, Pt. 8, 402.)

Lonchocarpus

Timbo Root Exports Increased—Brazil. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 32, 530-531. Exports of timbo root for 1937 and 1938.

Brazilian Timbo Exports Up. *Oil, Paint, Drug Rep.*, 1939, **136**, No. 7, 41. Production and export figures for 1937 and 1938.

Cube Root Exports Increased—Peru. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 37, 617. Gives exports from Peru for 1935-1938.

Alkaloids in Cube Root. By H. A. Jones. *J. Econ. Ent.*, 1939, **32**, No. 4, 596.

Others

Toxicity of Tephrosia. A Study of the Toxicity of *Tephrosia virginiana* Roots prepared by Several Methods. By A. F. Sievers and W. N. Sullivan. *Soap*, 1939, **15**, No. 9, 111-113.

Tephrosia virginiana und andere Nord-amerikanische Tephrosia-Arten als Insektizide. *Tropenpflanzer*, 1939, **42**, No. 7, 307-308. A note on North American *Tephrosia* spp. as insecticides.

Annual Report on the Department of Agriculture, Uganda, for the year ended June 30, 1938. Pt. II, p. 77. Brief note on properties of *Tephrosia vogelii* leaves.

The Action of certain Assamese Plants as Larvicides. By D. Manson. *J. Malar. Inst., India*, 1939, **2**, No. 1, 85-93. Includes tests of *Tephrosia vogelii* seeds on Anopheline larvæ. (*R.A.E.*, 1939, **27**, B, Pt. 10, 207.)

PYRETHRIN-CONTAINING MATERIALS

Pyrethrum Production Limited—Belgian Congo. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 36, 604.

Pyrethrum Production Small—Brazil. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 39, 658.

Work in Progress in the Botanical Division of the Department of Agriculture, Ceylon. *Trop. Agric., Ceylon*, 1939, **93**, No. 2, 80. Brief reference to experiments with pyrethrum in Ceylon.

Pyrethrum Acreage Decreased. *Soap*, 1939, **15**, No. 7, 121. Refers to Japan.

Pyrethrum at Ten Year Peak. *Soap*, 1939, **15**, No. 8, 115. Discussion of factors affecting prices of Japanese exports.

Japanese Pyrethrum Industry. *Chem. and Drug.*, 1939, **131**, No. 3100, 41.

Japanese Pyrethrum Industry. *Public Ledger*, 1939, July 12,5. Report of the annual meeting of representatives of growers, dealers and manufacturers at Kobe.

Pyrethrum Exports Increased—Kenya. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 30, 493. Exports from Kenya and Uganda, 1936-1938.

America Buying Kenyan Pyrethrum. *Chem. Tr. J.*, 1939, **105**, No. 2727, 172. Gives exports from Kenya and Uganda for 1937 and 1938 to the United Kingdom and United States.

La Coltura del Piretro nel Chenia. By L. M. Bologna. *Agricoltura Colon.*, 1939, **33**, 504-505. Notes on the cultivation of pyrethrum in Kenya.

Pyrèthre de Dalmatie. *Cultures Complémentaires au Maroc*, 1938, 251-253. Cultivation of pyrethrum in Morocco.

Pyrethrum Cultivation Limited—Netherlands Indies. *World Tr. Notes, U.S. Dep. Comm.*, 1939, **13**, No. 34, 572.

U.S. Pyrethrum Imports Drop ; High Prices Traced to Speculation. *Soap*, 1939, **15**, No. 7, 119.

Soil Conservation in Pyrethrum Fields. *E. Afr. Agric. J.*, 1939, **5**, No. 1, 47-56.

The Manurial Requirements of Pyrethrum (*Chrysanthemum cinerariæfolium* Trev.) By J. T. Martin, H. H. Mann and F. Tattersfield. Pp. 10 + 2 plates, 10 × 7. (Harpenden, Herts.: Rothamsted Experimental Station, 1939.) Reprinted from *Ann. Appl. Biol.*, 1939, **26**, 14-24.

Recent Progress of Chemistry of Pyrethrum Flowers. By H. L. Haller and F. B. LaForge. *Pests*, 1939, **7**, No. 5, 9.

The Identity of Pyrethrosin with Chrysanthin and Non-identity with Geigerin. By M. S. Schechter and H. L. Haller. *J. Amer. Chem. Soc.*, 1939, **61**, No. 6, 1607-1609.

Esters from Pyrethrin I. *Soap*, 1939, **15**, No. 10, 113. Physical constants and toxic properties of pyrethrin esters.

Testing of Pyrethrum Insecticides. By W. E. Edmonton. *Pharm. J.*, 1939, No. 3958, 289.

Pyrethrum Extract. *Soap*, 1939, **15**, No. 10, 113. Describes the preparation of a high-percentage product.

Experiments with anti-larval oils. *Planter, Malaya*, 1939, **20**, No. 6, 276-277. Includes results of tests with adding pyrethrin extracts to various mineral oils.

Insects in Aircraft. By F. G. S. Whitefield. *Nature*, 1939, **144**, 158. Deals with the problem of the urgency of control of insects in aeroplanes flying over tropical Africa.

Insects in Aircraft. By F. P. Mackie. *Nature*, 1939, **144**, 250-251. Relates to the use of pyrethrum sprays.

Household Insects and their Control. By A. Gibson and C. R. Twinn. *Publ.* 642 (1939) *Dept. Agric. Canada*. Includes use of pyrethrum in control of pests.

Biennial Report of Insect Control Work conducted by the National Agricultural Research Bureau, October 1935-June 1937. *Spec. Publ.* 29 (1938). *Agric. Res. Bur. China*. Includes tests on control of various caterpillars with a suspension of pyrethrum in sodium carbonate solution and on toxicity of pyrethrum extracts extracted in kerosene for varying periods. (*R.A.E.*, 1939, **27**, A, Pt. 8, 449.)

Investigations on Insect Pests of Brassica Seed Crops in Romney Marsh, I and II. By S. G. Jary and M. D. Austen. *J. S.E. Agric. Coll. Wye*, No. 44, July 1939, 73-83, 84. Part I includes tests of pyrethrum dust against *Meligethes aeneus* F. and Part II deals with atomised pyrethrum fluid.

Biological and Control Studies on the Clover Leafhopper. By T. C.

Watkins. *J. Econ. Ent.*, 1939, **32**, No. 4, 561-564. Describes the results obtained with using several insecticides including pyrethrum.

Resistance to Insecticides. The Effect of Knockdown and Light Doses on the Resistance of Houseflies to Pyrethrum Sprays. By E. M. McGovran, W. N. Sullivan and G. L. Phillips. *Soap*, 1939, **15**, No. 8, 88-90.

The House-fly as a Danger to Health. Its Life-History and How to Deal with it. By E. E. Austen. *Econ. Ser. No.* 1, *Brit. Mus.* (*Nat. Hist.*), *Fourth Ed.* Use of pyrethrum in control.

The Control of Household Insects in South Africa. By B. Smit. *Bull.* 192, *Plt. Indust. Ser.* 35 (1938), *Dept. Agric. Un. S. Afr.* Use of pyrethrum in control of houseflies.

Domestic Mosquitoes. By F. C. Bishopp. *Leafl. No.* 186, *U.S. Dep. Agric.* Use of pyrethrum spray for control recommended.

The Mosquitoes of the South-eastern States. By W. V. King and others. *Misc. Publ.* 336 (1939), *U.S. Dep. Agric.* Control of larvæ and adults by pyrethrum.

Insect Pests and their Control. *Agric. Gaz. N.S.W.*, 1939, **50**, Pt. 1, 30. Includes control of *Nysius vinitor* Bergr. with pyrethrum-talc dust and of *Diryphus* sp. with the same dust and with pyrethrum spray. (*R.A.E.*, 1939, **27**, A, Pt. 8, 449.)

Der Samenzünsler *Paralispa* (*Aphomia*) *gularis* Zeller und seine Bekämpfung (The Pyralid, *A. gularis* and its Control). By H. Müller. *Anz. Schädlingsk.*, 1939, **15**, Pt. 5, 51-56. A proprietary pyrethrum mist spray proved effective against adults of this warehouse pest and also against *Ephestia elutella.* (*R.A.E.*, 1939, **27**, A, Pt. 10, 520.)

OTHER INSECTICIDE MATERIALS OF VEGETABLE ORIGIN

A Bibliography of Quassia. By L. R. Busbey. *E*483, 1939, *U.S. Dep. Agric.*

Biennial Report of Insect Control Work conducted by the National Agricultural Research Bureau, October 1935-June 1937. *Spec. Publ.* 29 (1938) *Agric. Res. Bur. China.* Includes tests of insecticides prepared from *Celastrus angulatus*, *Trypterygium wilfordi*, *Rhododendron sinensis* and *Millettia reticulata.* (*R.A.E.*, 1939, **27**, A, Pt. 8, 449.)

The House-fly as a Danger to Health. Its Life-History and How to Deal with it. By E. E. Austen. *Econ Ser. No.* 1, *Brit. Mus.* (*Nat. Hist.*), *4th Ed.* Use of hellebore in prevention of breeding in manure.

The Action of certain Assamese Plants as Larvicides. By D. Manson. *J. Malar. Inst. India*, 1939, **2**, No. 1, 85-93. Includes tests on Anopheline larvæ of *Blygonum flaccidum*, *Gardenia campanulata* fruits, and *Zanthoxylum hamiltonianum* roots, the toxic effect of which is due to the presence of saponin. (*R.A.E.*, 1939, **27**, B, Pt. 10, 207.)

Problems concerning the Efficiency of Oils as Mosquito Larvicides. III. The Spreading Power of Oils and Methods of Increasing it. By D. R. P. Murray. *Bull. Ent. Res.*, 1939, **30**, Pt. 2, 211-236.

Volatile Oils as Ovicides for the Screwworm (*Cochliomyia americana* C. and P.). By R. C. Bushland. *J. Econ. Ent.*, 1939, **32**, No. 3, 430-431.

NOTE.—The reference in brackets—*R.A.E.*, etc.—which appears after certain items of the bibliography indicates the part and page of the *Review of Applied Entomology* in which an abstract of the publication mentioned can be found.

BOOK REVIEWS

Books for review should be addressed to " The Editor," Bulletin of the Imperial Institute, South Kensington, London, S.W.7.

PROPAGATION OF HORTICULTURAL PLANTS. By Guy W. Adriance and Fred R. Brison. Pp. ix + 314, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 20s.

In practice the work of plant propagation is usually carried out by men who rely solely on their personal observation and experience, and who are, in most cases, unacquainted with the scientific principles underlying the various operations. A knowledge of these principals combined with practical experience is, however, of great value to the horticulturist, especially when he is confronted with new problems, and it is in presenting the fundamentals that are the basis of good modern practice that this book should prove most useful to nurserymen and growers of commercial plants.

It might be assumed by the English reader that a work under this title would deal with the propagation of the numerous plants of various classes which are grown either for use or pleasure, but being written primarily for use in the U.S.A. the number of classes included under the term " horticultural plants " is comparatively few. For example, no mention is made of the great number of subjects grown in this country under the general term " Stove and Greenhouse " plants; neither is mention made of " hard-wooded " plants, ferns, orchids, succulents or alpines, in each of which groups are plants calling for special methods of propagation. The subjects which are specifically dealt with are grouped under the caption " Propagation of Certain Plants " in Chapter XIV. These comprise fruits (peach, plum, apricot, cherry, almond, cherry laurel, apple, pear, quince, pecan, walnuts, filberts, Tung nuts, persimmon, grape, bramble and bush fruits, strawberries, citrus and the avocado pear), roses, ligustrum and conifers. An earlier chapter treats of plants that are propagated by means of bulbs, corms, rhizomes and tubers; other chapters deal with methods of propagation by layering, cuttings, grafting and budding. Seeds and seed germination and forcing equipment are also dealt with.

The illustrations are numerous and purposeful; those in the chapter on " The growing and handling of nursery stock "

show the scale of operations as carried on in the States and the extent to which machinery is employed.

WILD FLOWERS OF AUSTRALIA. By Thistle Y. Harris, B.Sc. (Syd.). Pp. xviii + 198, $8\frac{1}{2} \times 5\frac{1}{2}$. (Sydney and London: Angus & Robertson, Ltd., 1938.) Price 8*s*. 6*d*.

The work is intended as a popular guide to the wild flowers of Australia. In reality it is a description of some 250 common plants, excluding Eucalyptus, which form the subject of a series of water-colour paintings by the late Adam Forster and which are well reproduced on a small scale—three or four on a plate. Within the limits necessarily prescribed the book should do much to stimulate a study of the Australian flora, but the beginner will, it is feared, find in his first season many commonly occurring plants which the book will not help him to identify. It is divided into two parts: the first contains the coloured plates, with a non-technical description of each plant and an outline of its distribution in Australia, and the second gives more precise and technical descriptions of the plants with botanical keys.

THE FUNDAMENTALS OF FRUIT PRODUCTION. By Victor Ray Gardner, Frederick Charles Bradford and Henry Daggett Hooker, Junr. Second Edition. Pp. xvi + 788, 9×6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 30*s*.

This volume has been prepared as a text-book for college students and gives the fundamental facts in the life and growth of the fruit tree, and the conditions that make it profitable as a producer of fruit. It is not a manual on how to grow fruits, but a guide to the principles underlying the practise learnt in the field and laboratory.

Much work has been done since the first edition appeared in 1922, and this has necessitated a thorough revision of the whole book. The text has been increased by 100 pages, whilst the references to literature have grown from just under 1,000 to over 1,500. The wide scope of the book can be gathered by a citation of the headings to the sections, which are: (1) water relations, (2) nutrition, (3) temperature relations, (4) pruning, (5) fruit setting, (6) propagation, (7) geographic influences in fruit production.

The general production of the book reaches the usual high standard of the works issued in the McGraw-Hill Series of Publications in the Agricultural Sciences, and it can be thoroughly recommended to all interested in the scientific aspects of fruit production.

Fruit Juices and Related Products. By V. L. S. Charley, B.Sc. (Hons.) Brist. and T. H. J. Harrison, D.Sc. Agric. (Syd.), D.I.C. (Lond.). Pp. 104, $9\frac{3}{4} \times 7\frac{1}{4}$. (East Malling, Kent: Imperial Bureau of Horticulture and Plantation Crops, 1939.) Price 5*s*.

This publication, issued as *Technical Communication No.* 11 of the Imperial Bureau of Horticulture and Plantation Crops, sets out to give an outline of the various factors—economic, nutritional and technical—concerned with the production of fruit juices. In view of the predominance of the apple industry, not only in England, but also in Canada, Australia and New Zealand, special attention is devoted to the technique of production of apple juice, briefer reference being made to grape, citrus and soft fruit juices. The section on apple juice covers all aspects of the question from the first treatment of the fruits, through the various processes of milling, clarification, storage (including sterilization), bottling, canning, etc. In addition to the more usual methods of sterilization by pasteurising and impregnation with carbon dioxide, newer processes for the stabilisation of fruit juices, such as the Schoop, Katadyn and Matzda, are also considered. The concentration, freezing and spray-drying of fruit juices are also discussed.

Other fruit products briefly dealt with include cider, fruit wines, fruit brandies, cider vinegar, and apple pomace as a source of pectin, stock food and fuel; and there are, finally, sections on methods of analysis and the choice of metal for equipment.

The treatise is very well illustrated by photographs of plant and machinery used in the fruit juice industry, and there is a good bibliography. It should serve as a very valuable guide to anyone proposing to start the manufacture of fruit juices in Empire countries.

Modern Cereal Chemistry. By D. W. Kent-Jones, Ph.D., B.Sc., F.I.C. Third Edition. Pp. vii + 720, $8\frac{1}{2} \times 5\frac{1}{2}$. (Liverpool: The Northern Publishing Co., Ltd., 1939.) Price 30*s*.

The first edition of this work was published in 1924 and was reviewed in this Bulletin (1925, **23**, 126-127). It has now reached a third edition, which is twice the size of the first one, and is likely to enhance the book's reputation as the standard work of reference on its subject.

The author has supplemented his own very extensive knowledge of his subject by reference to other sources of information wherever they were to be found, and the bibliography at the end of the book is claimed by the publishers to

comprise "probably the largest survey of scientific literature ever published on the subject of cereal chemistry."

As is indicated in the title, the book is primarily of interest to the cereal chemist, but it also supplies much very useful reading for millers and others concerned with the handling and utilisation of cereals.

THE PLANT ALKALOIDS. By Thomas Anderson Henry, D.Sc. Third Edition. Pp. viii + 689, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: J. & A. Churchill, Ltd., 1939.) Price 42*s*.

Henry's *Plant Alkaloids* is so well known to chemists and physiologists that little more is necessary here than to call attention to the appearance of this new edition. It is 15 years since the second edition was published, and in the intervening period such a vast amount of new information accumulated that it became necessary to re-write the book. To save space for the new material much of the information on methods for the determination of alkaloids and the descriptions of the purine bases have been omitted. But even so the volume has grown in size from 464 to 689 pages. The arrangement of the matter is the same as before, being primarily on the basis of a chemical classification according to nuclear structure, with such modification in a biological direction as appeared necessary in certain instances, thus reflecting the trend of modern research work.

A TEXTBOOK OF PHARMACOGNOSY. By T. C. Denston, B.Pharm., A.I.C., Ph.C., F.L.S. Third Edition. Pp. xvi+583, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: Sir Isaac Pitman & Sons, Ltd., 1939.) Price 20*s*.

This is a textbook for students taking the Chemist and Druggist Qualifying Examination, and it has been compiled with due regard to the syllabus for that examination.

The first section deals with drug constituents (glycosides, alkaloids, etc.), and the next with the cultivation, preparation, drying, etc., of drugs. There follow a number of sections consisting of monographs devoted to individual drugs, classified under the headings "leaves," "flowers," and so on, each monograph containing careful instructions for practical work. Finally, there is a very useful section consisting mainly of tables and maps which gives the geographical distribution of all the principal drugs.

The third edition of the book has been considerably revised, and the requirements of the Addendum, 1936, to the British Pharmacopoeia have been incorporated in the monographs

dealing with individual drugs. The numerous drawings are carefully executed with a view to bringing out the specific and diagnostic characters of the drugs rather than those of less immediate importance to the student. There are also a number of photographs illustrating drug plants and the preparation of drugs.

USES OF LAC. By H. K. Sen, M.A., D.I.C., D.Sc., F.N.I., and S. Ranganathan, B.A. Pp. 78, 7 × 4¾. (Namkum, Ranchi, Bihar, India: Indian Lac Research Institute, 1939.) Price Re. 1, As. 4.

The authors of this publication describe it as "an attempt to present to the interested commercial public a short but connected account of the various uses of shellac (and seedlac) in the order of their importance in the industries."

Though not intended as a handbook for the specialist it is something more than a "popular booklet." It includes a number of chapters dealing with the various uses of shellac. Principal among these is, of course, the gramophone record industry, the technical side of which is described in some detail. It is estimated that well over 200 million records are produced annually, representing a consumption of 220,000 cwts. of shellac for this purpose alone. The "stock" from which gramophone records are made contains about 25 to 30 per cent. of shellac, and this industry probably accounts for about one-third of the total export of shellac from India.

Other chapters are concerned with electrical insulating materials, protective and decorative finishes, the hat industry, sealing wax, grinding wheels (in the manufacture of which shellac is used as a binding material), and miscellaneous applications.

An interesting chapter on recent research developments deals with work carried out by the Indian Lac Research Institute, of which Dr. Sen is Director, and the London Shellac Research Bureau, the results of which have appeared in Bulletins and Technical Papers issued by those two bodies, and in other publications. There are two appendices, on the manufacture of shellac and on specifications for seedlac and shellac.

The book contains a number of useful recipes, but its object is rather to "stimulate new ventures and researches in lac" than to serve as a workshop formulary.

Though the construction of the book is such as to facilitate easy reference, an index would be a useful improvement in a second edition.

CASEIN AND ITS INDUSTRIAL APPLICATIONS. By Edwin Sutermeister and Frederick L. Browne. Second Edition. Pp. 433, 9 × 6. (New York: Reinhold Publishing Corporation; London: Chapman & Hall, Ltd., 1939.) Price 32*s*. 6*d*.

This is one of the series of Scientific and Technologic Monographs of the American Chemical Society. During the twelve years that have elapsed since the first edition appeared the scientific study of casein has made great advances, and its industrial applications have extended considerably. The whole field of the manufacture, chemistry, testing, storage and uses of casein is covered by the united contributions not only of the two editors whose names appear on the title-page but of others who are specialists in particular branches of the subject. Each chapter is followed by a list of references to publications, and the exhaustive nature of the book may perhaps be indicated by the fact that the author index contains about 1,400 names and the subject index over 2,000 entries.

PLANT PHYSIOLOGY. By Edwin C. Miller, Ph.D. Second Edition. Pp. xxxi + 1201, 9 × 6. (London: McGraw-Hill Publishing Company, Ltd., 1938.) Price 45*s*.

This is a book of particular value as a reference work by virtue of its detailed discussion of the subject and the exhaustive bibliography that accompanies each chapter. (Taking at random the chapter on "The Elements Absorbed by the Plant," we find some 800 references, and with few exceptions these are mentioned or discussed in the text.)

It is inevitable that in a detailed work of this kind there should be some inequality of treatment, as the author will naturally tend to give greater space to the aspects of the subject in which he has specialised. In the present case it is rather the chemical side that has received fullest treatment and for which the book is especially valuable. The section on enzymes, for example, is most detailed, and contains information which cannot be found in many books devoted entirely to that subject. Partly as a result of this angle of approach the scope for illustration is somewhat restricted, but it is felt nevertheless that much more could have been done in this respect.

A useful feature is the general author index covering all the bibliographical references given with the separate chapters. There is also a good subject index.

The book was originally published in 1931, and in this, the second edition, the text has been brought in line with recent research work, while certain new topics have been introduced.

The questions which followed the chapters in the first edition have been omitted in order to conserve space, but this does not in any way detract from the merits of the book in its chief function—as a reference work.

BOOKS RECEIVED FOR REVIEW

AGRICULTURE IN THE TWENTIETH CENTURY. Essays on Research, Practice, and Organization to be presented to Sir Daniel Hall. Pp. x + 440, $8\frac{3}{4} \times 5\frac{1}{2}$. (Oxford: The Clarendon Press; London: The Oxford University Press, 1939.) Price 15*s*.

LAND UTILIZATION IN AUSTRALIA. By S. M. Wadham and G. L. Wood. Pp. xix + 360, $9\frac{3}{4} \times 6\frac{3}{4}$. (Melbourne: Melbourne University Press; London: Oxford University Press, 1939.) Price 21*s*.

REPORT ON THE DEVELOPMENT OF AGRICULTURE IN THE BAHAMAS. By E. A. McCallan. Pp. 107, $10\frac{1}{2} \times 7$. (Nassau, Bahamas: The Nassau Guardian, Ltd., 1939.)

OUR NATURAL RESOURCES AND THEIR CONSERVATION. Edited by A. E. Parkins and J. R. Whitaker. Second Edition. Pp. xiv + 647, 9×6. (New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd., 1939.) Price 25*s*.

THE JOURNAL OF THE SOUTH-EASTERN AGRICULTURAL COLLEGE, No. 44, 1939. Edited for the College by S. Graham Brade-Birks, M.Sc., D.Sc., F.Z.S. Pp. 264, $10\frac{1}{2} \times 7\frac{1}{4}$. (Wye, Kent, 1939.) Price 7*s*., post free; to residents in Kent and Surrey, 4*s*., post free.

LAND DRAINAGE AND RECLAMATION. By Quincy Claude Ayres, C.E., and Daniels Scoates, A.E. Second Edition. Pp. xi + 496, 9×6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 26*s*.

BRITISH ISLES CONFERENCE ON AGRICULTURAL CO-OPERATION, 1939. Report of Proceedings held at Aberystwyth or June 9 and 10, 1939. Pp. xiv + 112, $8\frac{1}{2} \times 5\frac{1}{2}$. (London P. S. King & Son, Ltd., 1939.) Price 2*s*. 6*d*.

FARM SHOP PRACTICE. By Mack M. Jones, M.S. Pp. xiii + 315, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 17*s*. 6*d*.

LE SOYA ET LES INDUSTRIES DU SOJA. By A. Matagrin. Pp. x + 390, 7¼ × 5½. (Paris: Gauthier-Villars, 1939.) Price 60 frs.

FRUIT CROPS. Principles and Practices of Orchard and Small Fruit Culture. By T. J. Talbert and A. E. Murneek. Pp. 345, 9¼ × 6. (London: Baillière, Tindall & Cox, 1939.) Price 19*s*.

FRUIT PECTINS. Their Chemical Behaviour and Jellying Properties. By C. L. Hinton, F.I.C. Pp. vii + 96, 9½ × 6¼. *Dept. Sci. Indust. Res., Food Invest. Spec. Rep., No.* 48. (London: H.M. Stationery Office, 1939.) Price 1*s*. 6*d*.

VEGETABLE CROPS. By Homer C. Thompson, Ph.D. Third Edition. Pp. xi + 578, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 33*s*.

DIRECTORY OF PAPER MAKERS OF GREAT BRITAIN AND IRELAND FOR 1939. Pp. xix + 299, 10½ × 7½. (London: Marchant Singer & Co., 1939.) Price 5*s*.

THE DISTRIBUTION OF OPIUM CULTIVATION AND THE TRADE IN OPIUM. By Tj. J. Addens, D.Sc. Pp. ix + 129, 9½ × 6¼. (Haarlem: Joh. Enschedé en Zonen, 1939.)

DESTRUCTIVE AND USEFUL INSECTS. Their Habits and Control. By C. L. Metcalf, M.A., D.Sc., and W. P. Flint. Second Edition. Pp. xvi + 981, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 50*s*.

THE STRUCTURE OF ECONOMIC PLANTS. By Herman E. Hayward. Pp. x + 674, 9¼ × 6¼. (New York: The Macmillan Company; London: Macmillan & Co., Ltd., 1938.) Price 22*s*.

EXPERIMENTS IN PLANT PHYSIOLOGY. A Laboratory Textbook. By Walter E. Loomis, Ph.D., and Charles A. Shull, Ph.D. Pp. xiv + 213, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 12*s*.

ANIMAL BREEDING. By A. L. Hagedoorn, Ph.D. Pp. 304, $8\frac{1}{2} \times 5\frac{1}{2}$. (London: Crosby Lockwood & Son, Ltd., 1939.) Price 15*s*.

SILVICULTURE OF THE TREES OF TRINIDAD AND TOBAGO, BRITISH WEST INDIES. By R. C. Marshall, B.Sc., M.A., Dip.For. Pp. xlvii + 247, $9\frac{1}{2} \times 6\frac{1}{4}$. (Oxford: University Press, London: Humphrey Milford, 1939.) Price 21*s*.

FOREST TREES AND TIMBERS OF THE BRITISH EMPIRE. IV. FIFTEEN UGANDA TIMBERS. By W. J. Eggeling, B.Sc., and C. M. Harris, B.A. Pp. 120, $9\frac{1}{2} \times 6$. (Oxford: The Clarendon Press, London: Humphrey Milford, Oxford University Press, 1939.) Price 7*s*. 6*d*.

A HANDBOOK OF EMPIRE TIMBERS. Edited by H. A. Cox, M.A. Pp. vii + 214, $9\frac{1}{2} \times 6\frac{1}{4}$. Department of Scientific and Industrial Research, Forest Products Research. (London: His Majesty's Stationery Office, 1939.) Price 3*s*. 6*d*.

A HANDBOOK OF HOME-GROWN TIMBERS. Second Edition. Pp. vi + 87, $9\frac{1}{2} \times 6\frac{1}{4}$. Department of Scientific and Industrial Research, Forest Products Research. (London: His Majesty's Stationery Office, 1939.) Price 2*s*.

THE INFLUENCE OF VEGETATION ON CLIMATE IN WEST AFRICA, with particular reference to the protective aspects of forestry in the Gold Coast. By H. W. Moor. Pp. 15, $9\frac{3}{4} \times 6$. Imperial Forestry Institute, University of Oxford, Institute Paper No. 17. (Oxford: Imperial Forestry Institute, 1939.) Price 1*s*.

THE MANAGEMENT OF FARM WOODLANDS. By Cedric H. Guise, B.S., M.F. Pp. viii + 352, 9×6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 20*s*.

ECONOMICS OF PRIVATE FORESTRY. By Ralph W. Marquis, Ph.D. Pp. viii + 219, 9×6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 18*s*.

PRINCIPLES OF FOREST ENTOMOLOGY. By Samuel Alexander Graham. Second Edition. Pp. xvi + 410, 9×6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 24*s*.

THE NEW ASPECT GEOGRAPHY—COMMODITIES. By C. Midgley, M.Sc. Pp. 271, $8\frac{1}{4} \times 5\frac{1}{2}$. (Exeter: A. Wheaton & Co., Ltd., 1939.) Price 3*s*.

GERMAN-ENGLISH SCIENCE DICTIONARY for Students in the Agricultural, Biological and Physical Sciences. By Louis De Vries. Pp. x + 473, 7×5. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 18*s*.

MINERAL RESOURCES

ARTICLES

PROGRESS OF MINING IN TANGANYIKA TERRITORY

By Sir Edmund Teale, D.Sc., M.Inst.M.M., F.G.S.

Value of Mineral Production

The mineral production figures for the Territory are a good index of general progress. They do not record the ups and downs of individual enterprises which are particularly characteristic of most new mining fields, but they serve as a summing up of the general trend. In this respect the outlook is most encouraging in spite of the lack of financial support from outside sources during the past few years.

It will be seen that the current year, 1939, marks the most notable advance in gold production in the history of the country which bids fair to double that of the preceding year. This is due to the coming into production of Geita and Zaza Mines, and to improved mining and milling conditions at Buhemba and Mara, together with the steady expansion of small-scale mining enterprises.

The following figures indicate the value of the gold production in comparison with that of the total mineral production of the Territory during the past five years:

	Value of Gold Produced. (£)	Value of Total Mineral Production. (£)
1934	291,112	363,842
1935	369,507	451,973
1936	490,490	594,128
1937	526,338	652,442
1938	589,135	703,405

The table on page 612 shows in detail the mineral exports for June 1939 in comparison with those for June 1938, together with comparative figures of exports for the first six months of 1939 and 1938.

TANGANYIKA TERRITORY—SUMMARY OF MINERAL EXPORTS FOR JUNE 1938 AND 1939 WITH COMPARATIVE STATEMENT FOR THE FIRST SIX MONTHS OF 1938 AND 1939.

Mineral.	June 1939.		June 1938.		Jan.-June 1939.		Jan.-June 1938.	
	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.	Quantity.	Value.
Gold (*Unrefined Bullion*)—	(*Troy oz.*).	(£).	(*Troy oz.*).	(£).	(*Troy oz.*).	(£).	(*Troy oz.*).	(£).
From Lupa Goldfield—Alluvial .	1,996	12,815	2,633	16,124	13,154	83,911	16,230	99,300
From Lupa Goldfield—Reef .	4,815	23,230	1,629	9,032	19,175	96,509	9,502	43,973
From Musoma District—Reef .	3,208	15,995	2,401	11,416	23,546	121,187	20,617	98,422
From Mwanza District—Reef .	5,530	24,203	22	129	22,899	83,319	77	383
From Singida District—Reef .	1,134	6,662	904	4,338	5,741	29,179	5,627	27,899
From Singida District—Alluvial .	—	—	—	—	—	—	4	23
From Morogoro District—Alluvial	4	24	—	—	70	474	21	136
From Dodoma District—Alluvial .	—	—	1	5	—	—	53	280
From Kigoma District—Alluvial .	145	920	—	—	634	3,923	83	491
Total	16,832 *oz.*	83,849	7,590 *oz.*	41,044	85,219 *oz.*	418,502	52,214 *oz.*	270,907
Diamonds	38 *cts.*	331	208 *cts.*	197	1,727 *cts.*	4,048	1,400 *cts.*	1,839
Tin-ore	30 *tons*	4,810	22 *tons*	2,757	165 *tons*	26,223	222 *tons*	29,145
Tungsten-ore	6 *cwt.*	58	—	—	6 *cwt.*	58	45 *cwt.*	414
Salt*	553 *tons*	3,488	472 *tons*	2,951	2,205 *tons*	13,553	2,099 *tons*	13,159
Total value		92,536		46,949		462,384		315,464
Mica (Sheet)	2·8 *tons*	—	—	—	14·9 *tons*	—	9·0 *tons*	—
Mica (Waste)	—	—	—	—	2·0 *tons*	—	8·0 *tons*	—

* *The figures for salt do not include the quantities sold for local consumption.*

Several noteworthy features are at once apparent. The production of gold from reef mining on the Lupa field has increased materially and now greatly exceeds that obtained from alluvial mining. This is due on the one hand to the marked falling off of alluvial production and, on the other, to

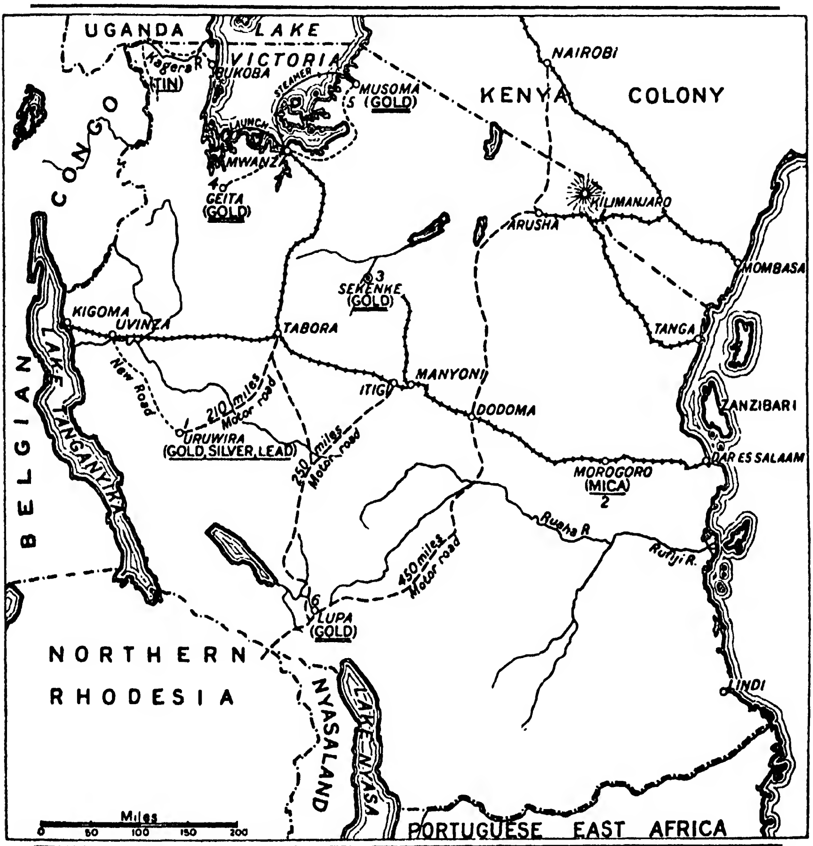

FIG. 1—SKETCH-MAP OF TANGANYIKA TERRITORY SHOWING MINING AREAS.

the steady expansion of reef mining resulting from the operations of small workers and the coming into production of the Saza Mine of New Saza Mines Ltd. In the Mwanza district the new mill of the Geita Gold Mining Company Ltd., which treats 250 tons per day, has now been in operation since the beginning of the year and is now the largest individual producer in East Africa. In the Musoma district the Mara Mine of the South and Central African Gold Mines Ltd. still holds premier

place as a producer for that district, but the Buhemba Mine of the South Nyanza Development Co., Ltd., with its new mill capable of treating 100 tons a day will be a serious rival during the last six months of 1939. The total value of gold produced for the month of June 1939 was more than double that for the corresponding month of 1938.

In the present review we may with profit consider:

(1) What has been done in the past both by Government and by private enterprise towards the development of the mineral resources, and with what success;

(2) Suggestions regarding the future.

What has been done

Communications

One of the most serious handicaps to development of any kind in a new country is lack of suitable and reliable means of transport. Much has been done to remedy this trouble, but much yet remains to be done. It is all too easy, with immediate defects in view, to forget the conditions of the past which have been so greatly improved.

The Lupa goldfield, when first discovered and for some years later, was without internal roads. The nearest road at Mbeya was some 40 to 50 miles distant over a mountainous and difficult footpath, Mbeya itself being more than 400 miles from the railway at Dodoma over a track rough and difficult even in the dry season, but quite impassable during the rains. The whole of that route is now traversed by a well-graded road passable in almost all weathers, and with permanent bridges and culverts in place of those which were liable to annual demolition during the rains. Within the field itself main trunk roads and bridges have been constructed, and many side tracks constructed by private enterprise provide a network of communications, making almost every part of the field accessible to motor transport. A much shorter outlet to the Central Railway at Itigi, which reduces the distance to the centre of the field from 450 to 250 miles, has now been constructed, and its route avoids the long and steep gradients which characterise the Dodoma-Mbeya route. The advantages thus accruing to the mining industry have been very considerable and are reflected in greatly reduced freight rates for all stores and greater regularity of supply.

The field has had the advantage now for some years of being adjacent to the Mbeya aerodrome on the main Central African Airways route, providing quick communication with Rhodesia and South Africa to the south, and linking up at Kisumu to the north with the Imperial Airways main route to London. An aerodrome has recently been constructed at Chunya in the centre of the field, and it is expected that this will soon be a regular port of call on the Central African north-south route. In addition, the Wilson Airways hire-services provide a means of rapid communication with almost all parts of the Territory.

The building of the branch railway line from Manyoni to Kinyangeri *via* Singida was not adopted with the main object of assisting the mining industry, but it has had the advantageous effect of reducing the distance of the Sekenke mine from its rail head by over a hundred miles. A graded road some 45 miles long, not yet passable in all weathers, has been built over the Iramba plateau to the mine. This is a case where improved transport facilities are particularly important in relation to working costs, for the mine depends on heavy oil fuel for its power.

The mines of the Lake Province lie at varying distances from the edge of the lake, generally less than 50 miles but in a few cases 80 to 100 miles or more from the nearest lake port. The relative proximity of most of the mines to the lake, with its organised water-transport linking up the railway systems of Tanganyika and Kenya, gave these mining fields initial advantages regarding transport as compared with more distant fields like the Lupa. With the exception of Geita, where local wood fuel for producer-gas purposes is abundant, practically all the mines depend on heavy oil for fuel. Regular transport facilities between the mines and the lake port are therefore particularly important.

The recent expansion in the scale of operations at several of the mines in this region has put an undue load on existing transport facilities. Nothing like the amount of money spent on communications to the Lupa field has been devoted to road construction in the Lake Province, for the more remote and less accessible regions demanded first attention. Increased production, development and accompanying traffic of the region, however, are now requiring urgent consideration.

The greatest mining activity has taken place in the vicinity of the Geita mine and associated holdings, which lie some 60 to 70 miles in a west-south-west direction from the lake port of Mwanza, which is also the rail head from Dar es Salaam. This area from the start, however, has used Mombasa as its seaport, all mining machinery and stores being brought by rail *via* Kenya to Kisumu on Lake Victoria, thence by water transport to Nungwe Bay (an arm of Emin Pasha Gulf), whence a road was constructed by the Company to the mine, a distance of some 16 miles.

The importance of this new area soon demanded speedier communication, and the Wilson Airways were induced to establish a regular weekly air service joining Kisumu and Nairobi to the field, calling at Musoma, Mwanza and other places *en route.* When the demand for direct road communication with Mwanza became evident, the Government arranged for a pioneer track to be made from Karuma on the west side of the Smith Sound, and a ferry capable of taking a motor car or lorry across Smith Sound to Mwanza was established by private enterprise. The demand has now grown into the need of an all-weather road and safer and more commodious ferry service.

The holdings of the Geita and associated mining companies are situated in country which, at the time of the discovery of the prospects, was without internal roads and was isolated except by access from the lake or by primitive native paths. The Company was therefore faced with the task of dealing with its own internal communications. About 40 miles of properly constructed all-weather road was made, and many miles of somewhat lower-grade track for fuel, timber and other haulage purposes. An aerial ropeway 9 miles long and capable of bringing 100 tons of ore daily from Ridge 8 has also been completed. A landing stage and crane at Nungwe Bay were established to handle all stores and machinery brought by tug and lighter across the lake.

In this way a modern mine, with an attractive mining camp for about 100 Europeans and over 3,000 Africans and Asiatics has come into being in a relatively short time in what was originally uninhabited bush.

The tinfields of Karagwe, which lie in the extreme north-west portion of the Territory bordering on the Belgian Man-

dated Territory to the west and Uganda to the north, also until recently represented another case of isolation.

The development of this area has in the past been seriously handicapped by poor and unsatisfactory communications. The Kagera River, one of the strongest-flowing streams in East Africa, borders it on the north. It is navigable for a powerfully-engined tug from its mouth in the lake to Nyakinassi, about 30 miles distant from the nearest part of the northern (or Ibanda) tin area, but until recently the southern (or Kyerwa) field was completely cut off from the northern area by a steep-sided range. The stores of food and exports of tin had to go to and from this section of the field *via* Bukoba, a distance of over 100 miles, most of which was rough and with some very difficult gradients. It was impassable during the rains. The recent establishment by the Straits Tin Smelting Co. of a tin-buying centre at Kikagati on the Kagera River in Uganda proved a great boon at once to all those who were able to take advantage of it, but the southern mines of Kyerwa were not able to use it.

Government eventually came to the rescue by constructing a road over the difficult range of hills, thus joining up the southern and northern fields. A ferry was also installed, capable of taking loaded lorries over the Kagera, to provide easy access to Kikagati. A circuitous motor journey of nearly 150 miles from the Kyerwa region to the tin market is now replaced by a route of about 30 miles. Other improvements of the service are due for consideration, but the present advance is a very material advantage.

The latest mineral field, that of Uruwira, is another instance of a discovery in an area devoid of any reliable means of access. It is situated to the south-west of Tabora on the Central Railway and could be approached only during the dry season along an indifferent motor track of some 200 miles from Tabora. A road along a new route from the railway at Uvinza has now been made partly by the Government and partly by the Uruwira Goldfields Ltd., which reduces the distance to about 110 miles. It should be possible to convert this if necessary into an all-weather road. An aerodrome is also under consideration.

It is clear from the preceding remarks that both Government and private activities have been very greatly concerned

with conditions of communications and means of improving them.

Geological Survey

A permanent Geological Survey was established in the Territory in 1926 and has steadily pursued a programme of mapping mineral areas and exploration in unmapped regions with a view to determining areas of likely mineralisation.

With the assistance of the Colonial Development Fund this service was increased and the work of the geological laboratory was expanded to cover not only assaying for the public but also metallurgical testing of ores in order to give advice, chiefly to small workers. Bulletins or Short Papers, with accompanying geological maps dealing with all the existing mineral fields, have now been issued. They are based on the surface evidences available at the time, but continued attention to the underground geology is necessary in order to modify or supplement the observations of the first surveys, which were naturally provisional. Much unexplored and unmapped country still remains to be surveyed.

Mining Loan Fund

The conditions in the Territory regarding mineral occurrences show a good deal of resemblance to those in Southern Rhodesia in that there are many gold lodes which are not large enough to attract company enterprise but which offer opportunities for small-scale operations run by individuals or small syndicates. The small-reef worker is often handicapped, especially in the initial stages, by being unable to find enough capital, first, to test his property adequately, and second, to procure an efficient mill with which to recover the gold profitably.

Following the example of Southern Rhodesia, a Mining Loan Fund was set apart to advance money to equip an incomplete mill or to purchase a complete new plant suitable for making a profitable recovery from the ore. A property for which an application for assistance has been made is reported on by the Government Mining Inspector and submitted to the Mining Loan Board for consideration.

After about 12 months trial, however, it was found that very few applicants could qualify, for they were not able to offer the security demanded by the conditions of the loan.

Many had promising probable ore, but it was not proved. The cost of opening up, necessary to turn the probable ore into proved ore, was in most cases the stumbling block, though often sums of less than £500 would suffice to decide. The assistance wanted was therefore just out of reach.

The granting of small sums up to £500 as a pilot, or provisional, loan in cases of definite promise to meet this situation is now under consideration, and if approved, it is expected that the desired help will then be brought within reach of many more small workers.

Technical Advice

Small-scale mining in many countries, especially in new countries, is often attempted by men with little training or experience, and this results in inefficient methods of production. It is believed that a great deal can be done to remedy this by the provision of technical advice, employing trained and experienced technical officers to study the problems and difficulties of the individuals concerned. This is all the more important when advances have been made out of the Loan Fund towards equipment. It has been proposed therefore to depute certain Government officers to give advice in mining and milling and in mining geology.

Mining Scholarships

It is desirable to consider the future as well as the present conditions. With this end in view Government has approved of the proposal to grant annually three scholarships to local youths of European parentage in order to enable them to have two years training at the Bulawayo School of Mines, after which they will return to East Africa to work as apprentices at several recognised mines which have agreed to take them and give them facilities for obtaining a full practical experience. By this method it is hoped that suitable openings will be made available for local youths wishing to follow a mining course, and the standard of mining employees should be greatly improved.

Private Enterprise in Mining

Most of what has been recorded is due to Government

enterprise, but it is encouraging to note the many activities of individuals and companies which are additional or accessory to those of actual mining.

These include special geological surveys, road making, special camps for natives, medical and hospital facilities, financial assistance to small workers, and the education of natives. A few special instances are worth recording.

The special geological investigations at Saza by Dr. Gallagher, in the North Ilunga Area by Mr. Skerl, and at Geita by Mr. Roberts have not only been of value to the companies concerned, but have added considerably to the information concerning the gold occurrences of the Territory.

The road-making by Geita, Buhemba, Mara and Mpanda Mines respectively and others is specially noteworthy. Native mining camps of note include Geita, Kiabakari, Buhemba, etc.

The medical facilities at Geita include a well-built hospital, with modern operating theatre and X-ray apparatus, under the charge of a European Medical Officer. The most outstanding case of private financial assistance for small-scale operations is that provided by Nanak Chand of Musoma. The school at Kiabakari Mine, maintained by fees from the native miners, is a most interesting example of what sympathetic managership can achieve. Apart from direct revenue returns, therefore, there are many ways in which the country has benefited indirectly from the activities of those associated with local mining enterprises.

Future Possibilities

Mining ventures as a rule entail more risks than many other commercial enterprises and their life is usually limited, for the substance mined is a one-crop product ; it can only be taken out once and it is therefore most desirable that the work be done efficiently and with as little waste as possible. Though the mining industry, like other enterprises, is subject to the deleterious influences of booms and intervening depressions, the relatively stable price of gold has secured that section of the industry concerned with its production from the serious setbacks experienced by some of the base-metal miners. It was gold mining that came to the rescue of many parts of the Empire, including East Africa, during the last great depression.

The benefit would have been greater in this Territory than it has been had the country been more prepared to take advantage of the short gold boom. A continued policy of economic survey, which includes not only geological survey but a general stock-taking of all the resources of the country, should proceed uninterruptedly through boom or depression to secure reliable information on which sound planning for the future can be based.

To-day there is a lull; little or no capital is available for exploration or the financing of fresh mining enterprises, but Government can do much to tide over this gap by giving its continued support to those services previously enumerated.

These include continued attention to a sound economic survey of the country's resources which will include particularly water and mineral survey; a continued and vigorous attention to improved communications guided by the indications of the general survey; and with regard to mining in particular, the maintenance (and expansion if merited) of technical guidance in mining, metallurgy and geology to meet the present needs of the small-scale miner; a sufficient flexibility of the Mining Loan Fund to bring this form of assistance within reach of those who merit help; and, with an eye to the future, the improvement of the health of the native community, and the maintenance and extension of facilities for the training of local European youths for useful service in the country, as, in the case of mining, the opportunity of training in the Bulawayo School of Mines followed by apprenticeship later to the recognised East African Mines.

These observations are not complete; other lines of assistance could be suggested and considered, but it is believed that the foregoing are basic and important.

The prospects of mining in the Territory to-day, in spite of apathy from abroad and some discouragements, common to all ventures, from within, were never better, and they inspire confidence in the future, but it is wise to continue faithfully with the improvement of facilities of to-day and to be prepared to take advantage of future opportunities when they arrive.

THE CANADIAN MICA TRADE

By Dr. Hugh S. Spence

Bureau of Mines, Canada

The production of sheet mica in Canada has always been almost wholly of the phlogopite ("amber mica") variety. It is derived practically entirely from adjacent parts of Ontario and Quebec, within an area extending roughly from Kingston, on Lake Ontario, north-eastward into Hull and Papineau counties, Quebec. The mica-bearing series (pyroxenites) is probably continuous throughout this entire region, but is hidden for some distance south of the Ottawa river by a belt of later, sedimentary rocks. In Quebec, the pyroxenites extend for some distance both west and east of the main productive area, into Pontiac and Argenteuil counties, respectively, but production from these districts has been comparatively small. A few scattered amber mica occurrences are known in the Province as far east as Quebec city, but very little mining has been conducted on them.

Production of muscovite, or white mica, in Canada has been negligible. Small amounts have been recovered occasionally as a by-product from feldspar mining, but, in general, the proportion of sound, marketable sheet mica in Canadian pegmatites has proved too low for profitable mining for this mineral alone.

Mica mining in Canada has been at a low ebb for a number of years past, production being restricted for the most part to a few major operators working old, established mines. This has been in marked contrast to the situation in the earlier days of the industry, when large contributions were made to the total output by farmers and others who worked small mines on their properties during the off-season. Small operations were reported during 1938 on a few scattered properties in both Quebec and Ontario, but mostly of a short-lived, prospecting character, and resulted in only a small aggregate production. A little white mica (muscovite) was sold during 1937-38 by small operators in the Saguenay region, Lower St. Lawrence, as well as in Parry Sound district and near Mazinaw Lake in Abinger township, Addington county; in the last case, the material was recovered from old waste

dumps. Some of the Saguenay mica was an excellent grade of ruby muscovite. A small amount of sheet black mica (biotite or lepidomelane) was produced in Faraday township, near Bancroft, Ontario, from deposits opened some years ago as a source of grinding scrap for a mill (now inactive) at Bancroft: this mica occurs in very large crystals, and considerable quantities are available, but being of poor splitting quality and having a high iron content it would presumably be a poor electrical insulator.

An unusual kind of deposit of fine flake muscovite, or sericite, occurs at Baker Inlet, near Prince Rupert, B.C., the material of which, on account of its extremely friable nature and ease of grinding, should prove eminently suitable for the production of mica powder. About 200 tons of crude material has been mined to date and shipped to Vancouver for grinding and use in roofing. Production in 1938 was about 50 tons. The ground product is stated to have sold for $32.50 per ton f.o.b. Vancouver. Small trial shipments have also been made to the United States. On account of the friability and small particle size of the crude material, it breaks down to a fine powder with little destruction of the natural flakes; these are relatively thicker and heavier than those produced by grinding sheet mica, and the use of this mica in roofing manufacture is stated to reduce materially the loss of powder by dusting. A report on tests made in the Ore Dressing Laboratories of the Canadian Bureau of Mines upon a shipment of crude mica from this occurrence has been published (Report No. 748, July-Dec. 1934, Investigation No. 606).

The mica-grinding plant at the Blackburn mine, in Templeton township, Quebec, continued to produce various grades (mesh-sizes) of ground amber mica from mine and shop scrap, but sales were reported to be slightly less than in 1937: the product goes chiefly to the domestic roofing and rubber trades. Small amounts of scrap muscovite, imported from India, are ground for local roofing use in a plant in Vancouver. Scrap mica, as well as a small proportion of small-sized sheet, continues to be recovered from the waste dumps of old mines, and is exported to American grinding plants. Although many such old dumps have been worked over, much mine and shop waste still remains on certain properties; the market for scrap, however, has been dull in recent years and the price

currently offered ($9 per ton f.o.b. rail) is not very attractive to prospective shippers.

The following figures show the Canadian production of the five leading mica products in 1937 and 1938 :

	1937.		1938.	
	Quantity *lb.*	Value $.	Quantity *lb.*	Value $.
Knife-trimmed .	203,961	66,852	83,043	46,177
Thumb-trimmed	173,519	11,826	1,380	731
Splittings . .	72,500	32,495	51,444	22,254
Rough-cobbed .	106,917	12,090	—	—
Scrap . .	1,333,479	10,468	619,165	6,251
Total	1,890,376	133,731	755,032	75,413

The figures indicate marked decreases both in quantities and values for all grades of mica produced.

By the new Trade Agreement of 1938, effective since January 1, 1939, the United States tariff on Canadian phlogopite underwent some revision. The duty on untrimmed small sheet (yielding rectangular pieces not over 2 in. × 1 in.) was reduced from 15 per cent. to 10 per cent. *ad valorem*, and that on waste and scrap valued at not over 5 cents per pound was dropped from 25 per cent. to 15 per cent. The duty on ground mica was reduced at the same time from 20 per cent. to 15 per cent. Under the British Preferential Tariff, imports of mica and manufactures thereof into Canada are dutiable at 15 per cent. *ad valorem* ; under both the Intermediate and General tariffs, at 25 per cent.

The total recorded world production of mica of all classes and grades in 1937 was nearly 42,000 long tons, but this figure is definitely known to have included almost 25,000 tons of low-priced grinding scrap ; the remainder comprised sheet mica in various styles of trimming as well as splittings. The total sheet mica production was, therefore, about 17,000 tons. The great bulk of this was muscovite, as only Canada and Madagascar (combined output 844 tons) are sources of phlogopite. Canada's share of the world production, although very small, is important, because for certain uses (e.g. for heater plates) amber mica is preferred, if not, indeed, indispensible.

Exports of mica of all classes in 1938 were valued at $89,259 as compared with $171,770 in 1937. Imports, which consisted mainly of splittings, were valued at $86,803 as against $83,596 in 1937.

Sheet mica is marketed in various classes, depending on the amount of preparation the mine-run material receives. Much of the Canadian output was sold formerly in the semi-rough form, termed "thumb-trimmed," but the trade now calls largely for "knife-trimmed," a much higher grade of product. Price is governed largely by dimensions of sheet, and rises rapidly for the larger sizes. Quality, which is gauged by colour, softness, ability to split readily, as well as by freedom from cracks, creases, pin-holes and inclusions of foreign mineral substance, is also highly important. Good di-electric strength is a prime consideration, but most amber mica, except perhaps the very dark, high-iron varieties, possesses this in the required degree. For heater use, the mica must be able to withstand a temperature up to red heat without puffing or swelling, and phlogopite is inclined to be variable in this respect, particularly when it has undergone some degree of natural alteration (hydration) as is sometimes the case.

Of all industrial minerals, mica, in the sheet form, through the various stages of its mining, preparation for market, grading, etc., involves the greatest expenditure of labour and time per unit of quantity production, and it is by far the most costly of all such commodities. From its extraction from the earth to preparation in the form of trimmed or split sheets, each piece entails an individual hand operation. Mechanical preparation has made little progress, and the great bulk of the production is still handled by primitive hand-and-knife methods. The making of splittings by hand, particularly, is a slow and costly operation (an expert worker can split only about one pound per hour, at a labour cost of around 15 cents), consequently comparatively little mica is made into splittings on the American continent, most of this class of product coming from India, Madagascar, and other countries having an abundant supply of cheap labour.

The use of sheet mica is almost entirely for electrical insulation. It is cut or punched into an enormous variety of shapes and sizes, and in the form of splittings is bonded and pressed into large sheets that can be sawn, bored and machined into any desired article. Some clear mica (mostly muscovite) finds employment as stove windows, and in lighting equipment. Mica is used in making heavy-duty spark plugs for aeroplanes,

though a new ceramic product ("Corundite") of equal efficiency is said to be replacing it. Of possible vital importance to the mica trade is the recent discovery that films or plates having many of the desirable properties of mica, including comparable di-electric strength, can be made from colloidal dispersions of bentonite clay. Commercial development of the product ("Alsifilm") is now being planned, and a "synthetic mica" in sheets or rolls of any desired size and thickness may become possible by a process similar to that followed in the making of paper and at a very low cost.

Mica is a comparatively insignificant mineral from the point of view of tonnage production. Sheet mica is, however, a vital key mineral in industry, particularly in all forms of electrical equipment, in which no substitute for it has ever, up to the present, been found. Although the muscovite variety fills by far the largest share of the world demand, amber mica is essential for certain purposes, more especially where high heat-resistance is demanded. Although already drawn on extensively, Canadian reserves of amber mica are held to be still adequate to furnish important supplies, and any material price advance would probably result in a revival of mining and increased production. Canada shares the world market for amber mica with Madagascar, the two countries constituting the principal known sources of this variety. The depression in the Canadian industry in recent years has been largely attributable to the competition of more cheaply produced Madagascar mica, this being especially pronounced in the case of splittings. The better grades of Canadian amber mica are, however, considered superior in point of heat-resistance to much of the Madagascar product, and the improvement in trimming practice has resulted in a revived interest by the British trade in Canadian supplies of sheet mica for heaters, as well as for use in sparking plugs.

Fine flake or powdered mica has become an important industrial product, particularly in the United States, where a number of plants are engaged in its manufacture both by wet and dry systems of grinding. Most of the production goes to the roofing and rubber trade. New uses for the material include its combination with resin varnishes as a coating for foodstuff cans, and as a base in cleanser compounds. Increased interest is also being shown in its possibilities as a protective

inert pigment in paints, to which it is claimed to impart superior resistance to weathering and corrosion by fumes and liquids; the paint industry is foreseen as a large potential market for mica powder. Recent inquiries directed to the Bureau of Mines also indicate some interest in powdered mica as a fertiliser, presumably on account of its potash content (about 8-10 per cent.). Mica being extremely resistant to ordinary weathering influences, however, it is not clear how the potash might be expected to be released and made available for plant use. Large amounts of wet-ground muscovite mica are consumed in wallpaper manufacture, and some is also used in the ceramic type of insulating material termed "Mycalex"; up to the present most, if not all, of the supply of this product has been furnished by a single company in the United States, but in 1937 a plant for its manufacture was established in England. A method of separating flake mica from crushed rock or sand by means of the frictional electricity induced in the flakes during their passage down inclined glass plates has recently been announced by the U.S. Bureau of Mines.

The demand for phlogopite mica, which had shown an encouraging upward trend in 1937, remained rather dull throughout 1938, except for knife-trimmed larger sizes (2 in. × 4 in., 3 in. × 5 in., and upward). Japan was reported actively in the market for splittings, but, on the whole, dealers reported business as slack and spasmodic and trimming-shops were mostly only in part-time operation. The larger producers operate their own mica shops, but there are, in addition, various dealers who purchase rough-trimmed or mine-run mica from small operators and trim, grade and split it for sale either to other dealers and brokers or to consumers. There is also a considerable amount of farming out of this work, particularly splitting, in smaller rural communities, the labour being performed mostly by girls working at home on a piece-work basis.

Mica prices are difficult to ascertain, owing to the lack of reliable market quotations and to the system of trade discounts obtaining. Quality also has such a bearing on value that the only satisfactory method of getting information is to submit samples to an accredited dealer for a quotation. The mica market is subject to pronounced periodic fluctuations in

demand owing to prevailing trade conditions, as well as to the practice by consumers of laying in stocks considerably ahead of current requirements. According to dealers' reports, general price averages in 1938 remained substantially unchanged from those of the previous year, quotations being approximately as under:

Knife-trimmed sheet.	$ per lb.	*Splittings.*	$ per lb.
1 in. × 3 in.	·50	1 in. × 1 in.	·45
2 in. × 3 in.	·75	1 in. × 2 in.	·50
2 in. × 4 in.	1·00		
3 in. × 5 in.	1·75		
4 in. × 8 in.	2·25		
5 in. × 8 in.	3·00		

Ground mica (phlogopite) continued to sell as follows, according to fineness: 20 mesh, $25 per ton; 60 mesh, $30; 120 mesh, $45; all prices f.o.b. Ottawa, in ton lots.

PROGRESS IN COLONIAL MINERAL INDUSTRY

Comprising periodic statements on mining and geological activities received from Government Technical Departments overseas.

BECHUANALAND

The following statement received from the Chief Mining Commissioner shows the production of gold and silver for the three months ended August 31, 1939.

	Troy oz.	Value.
Gold, bullion	3,183·83	£27,362 5s. 1d.
,, fine	4,475·99	
Silver	160·98	£8 4s. 3d.

The gold premium amounted to £2,540 9s. 0d.

The increased production of gold over the previous quarter is accounted for by a larger output from the Monarch mine. Three small mines, which showed no returns for the last quarter, have added their contribution to the above figures.

BRITISH GUIANA

The following information regarding the mineral industry of British Guiana during the third quarter of 1939 has been received from the Acting Commissioner of Lands and Mines:

During the quarter 100 claim licences were issued; no exclusive permissions or concessions were granted.

Bauxite.—During the year all the bauxite mined has been won either from lands privately owned, or from those on which mining rights have been acquired by the Demerara Bauxite Co., Ltd. The output for the quarter under review amounted to 123,975 tons.

Diamonds.—With the object of assisting the diamond industry subsequent to the outbreak of hostilities in Europe, the royalty payable on gems was reduced from 50 cents to 15 cents per carat as from September 19, 1939. During the quarter 67,832 stones (8,333 $\frac{5}{16}$ carats) were produced, as compared with 69,173 stones (8,657 carats) in the previous quarter.

Gold.—The output of gold during the third quarter amounted to 10,258 oz. 5 dwt. 12 gr., thus showing a slight reduction compared with the previous quarter's output of 10,504 oz. 15 dwt. 10 gr.

BRUNEI

According to information supplied by the British Resident, the production of oil in the second quarter of 1939 amounted to 186,062·94 tons, and in the third quarter to 195,126·5 tons. These figures represent the net production after deducting water run off, and pumping losses between field and refinery.

CYPRUS

The following report has been received from the Inspector of Mines regarding mineral production during the period July 1, 1939, to September 30, 1939.

The outbreak of war had a serious effect on the exportation of all minerals during the latter part of the quarter.

The effect on the production and exportation of pyrites and cupreous concentrates was particularly noticeable and operations on the mines producing these raw materials were severely restricted, with the result that the rate of production shows a sharp decrease as compared with the previous quarter.

There was a large increase in the tonnage of asbestos exported.

No chrome ore was exported during the period under review.

There was very little prospecting activity.

MINERAL PRODUCTION AND EXPORTS, JULY-SEPTEMBER 1939

	Production. Tons.	Exports. Tons.
Cupreous pyrites (dry weight)		
Skouriotissa Mine	26,578	21,214
Mavrovouni Mine	164,111	61,307
Limni Mine	2,922	1,889
Kalavaso Mine	10,169	3,800
Cupreous concentrates (dry weight)		
Mavrovouni Mine	—	18,694
Chrome ore mined	4,598	—
		Troy oz. fine.
Gold (contained in ores, concentrates and precipitates)	—	5,403*
Silver (contained in ores, concentrates and precipitates)	—	29,712*
		Tons.
Asbestos (Tunnel Asbestos Cement Co., Ltd)		
Rock mined	612,500	—
Rock treated	147,752	—
Asbestos fibre	4,498	6,096
Other minerals exported		
Gypsum, calcined	—	656
Gypsum, raw	—	499
Terra umbra	—	1,826
Terra verte	—	½

* *Based on provisional returns.*

KENYA

Statistics showing the production of gold in the various Kenya goldfields for June and July have been supplied by the Acting Commissioner of Mines. The figures are summarised in the following table:

KENYA—PRODUCTION OF GOLD (JUNE AND JULY 1939)

Goldfield.	June.	July.	Total.
Kakamega			
Lode:			
Tons treated	10,138	9,576·5	19,714·5
Refined gold recovered oz.	2,761·36	2,650·17	5,411·53
Alluvial:			
Cu. yds. treated	36,465·80	39,120·20	75,586
Refined gold recovered oz.	213·96	284·13	498·09
No. 2 Area			
Lode:			
Tons treated	11,559·2	12,634	24,193·2
Refined gold recovered oz.	1,593·61	1,674·39	3,268
Alluvial:			
Cu. yds. treated	919	1,262	2,181
Refined gold recovered oz.	24·15	45·96	70·11
South Kavirondo			
Lode:			
Tons treated	4,703·56	4,788·2	9,491·76
Refined gold recovered oz.	1,066·89	976·41	2,043·30
Masai Province (Lolgorien)			
Lode:			
Tons treated	1,035	695	1,730
Refined gold recovered oz.	204·75	315·13	519·88

MALAY STATES (FEDERATED)

The following data for the third quarter of 1939 have been compiled from returns furnished by the Chief Inspector of Mines. The tin production for September is not available.

PRODUCTION OF TIN-ORE
(July and August 1939 only)

State.	Metal content (*Long tons*).	Value (£).
Perak	4,256	913,236
Selangor	2,189	469,081
Negri Sembilan	250	52,970
Pahang	277	60,079
Total	6,972	1,495,366

Other minerals produced during the quarter were: gold, 9,928 troy oz.; coal, 108,551 tons (all from Selangor, and excluding coal produced and consumed at the colliery); china clay, 106 tons; and haematite, 165 tons (all from Perak). Exports include wolfram, 6 tons; scheelite, 80 tons; and amang, 4,304 tons.

MALAY STATES (UNFEDERATED) AND MALACCA

According to returns furnished by the Chief Inspector of Mines, exports of minerals during the third quarter of 1939 were as shown below.

EXPORTS OF MINERALS, JULY-SEPTEMBER 1939

State.	Tin in ore at 75·5 per cent.	Gold.	Manganese ore.	Wolfram.	Bauxite.	Iron ore.
	(*Long tons.*)	(*Oz.*)	(*Long tons.*)	(*Long tons.*)	(*Long tons.*)	(*Long tons.*)
Johore	269	—	—	—	19,770	200,558
Kedah	85	—	—	51	—	—
Perlis	103	—	—	—	—	—
Kelantan	4	216	4,414	—	—	63,600
Trengganu	184	—	8,650	43	—	426,750
Malacca	50	1	—	—	—	—
Total	695	217	13,064	94	19,770	690,908

JOHORE

The following progress report on mining in the State of Johore during the third quarter of 1939 has been compiled from a statement submitted by the Acting Warden of Mines.

Tin-ore.—The production of tin-ore is regulated, and can only correspond to the permitted quota release plus an amount of tin-ore that is required to bring the stocks of tin-ore held on the mines to the full amount of stocks that it is permissible to hold under the international agreement.

Exports can only correspond with the permitted quota release, for each quota period which corresponds to a quarter of a year.

The exports of tin-ore from all sources during the quarter amounted to 127·89 tons in July, 36·25 tons in August, and 193·61 tons in September; the total export figure of 357·75 being valued at $517,199·30.

The tin-ore exports from Johore Bahru during the quarter amounted to 226·99 tons, from Kota Tinggi 116·39 tons, and from Penggerang 14·37 tons.

Fifty-eight mines were operating in the State during the quarter. The proportion of the total exports of tin-ore from European owned or managed mines was 42·32 per cent. as compared with 57·68 per cent. from mines under Chinese management.

Iron-ore.—Exports of iron-ore for July amounted to 78,167 tons, for August 47,553·40 tons, and for September 74,838·50 tons. The total export of 200,558·90 tons was valued at $1,002,794·50. Of this total 97,985 tons were exported from Endau (east coast) and 102,573·90 from Batu Pahat (west coast).

In Johore iron-ore is valued at $5·00 per ton for the purpose of assessing export duty, which is 10 per cent. *ad valorem.*

Bauxite.—Three open-cast bauxite mines were in operation during the period under review. Exports of bauxite amounted to 6,807·64 tons in July, 6,460·78 tons in August, and 6,501·11 tons in September. The total tonnage of 19,769·53 was valued at $88,847·65, and was exported from Batu Pahat (west coast).

In Johore bauxite is valued at the same rate as iron-ore for the purposes of assessing export duty, that is at $5·00 per ton, the export duty being 10 per cent. *ad valorem.*

Gold.—The production of gold during the quarter amounted to 4·0571 troy oz., valued at $235·31. Two small working mines were in operation during this period.

A royalty of 2½ per cent. *ad valorem* is paid on gold in Johore, the price being fixed at $58·00 per troy oz. by Government for the purpose of assessing royalty.

NEWFOUNDLAND

The following information regarding the mineral production of Newfoundland, for the third quarter of 1939, has been contributed by the Associate Government Geologist.

MINERAL PRODUCTION, JULY-SEPTEMBER 1939

	Tons.
Buchans	
Crude ore	117,400
Concentrates:	
Copper	14,894
Lead	9,332
Zinc	24,528
Gravity	117
Bell Island	
Iron ore	426,044
St. Lawrence	
Fluorspar	3,229
Aguathuna	
Limestone	192,217

NIGERIA

The following report on mining activities and mineral statistics for the third quarter of 1939 has been received from the Chief Inspector of Mines.

Tin.—The quota for free export was fixed at 45 per cent. of standard tonnage. During September a series of retrospective quotas raised the figure to 100 per cent.; finally, in October, the third quarter's retrospective quota became 120 per cent. of standard tonnage.

In spite of this considerable increase in quota the stocks on the mines totalled 2,480 tons metal, estimated at 72·5 per cent. tin.

Columbite.—A small demand for the metal continued during the quarter, some apparently having been sold to Germany.

Wolfram.—There was a steady demand for wolfram throughout the quarter.

Gold.—The gold produced was of fineness 930, and the total output for the quarter was valued at £53,107.

MINERAL PRODUCTION AND EXPORTS, JULY-SEPTEMBER 1939

	Production.	Export.
	Tons.	*Tons.*
Tin	3,601	2,960
Columbite	123·31875	33·75714
Wolfram	76·71696	55·03125
	Troy oz.	
Gold	7,391·194	—

NORTHERN RHODESIA

The following statements relating to mining activities during the third quarter of 1939 are taken from a report furnished by the Chief Inspector of Mines.

Prospecting.—Apart from the Concession Areas, on which routine prospecting, geological mapping and diamond drilling were continued, there was little activity. Nineteen prospecting licences were issued during the quarter, and four gold, one manganese and four mica locations were registered. One special grant, in respect of tin and wolfram, was also registered.

Mining.—The most interesting feature of the quarter was the coming into production of the Nchanga Mine. As from August 16 the copper quota was increased from 95 per cent. to 105 per cent. of the agreed basic tonnages, and as a result of the European war the rate of copper production of each of the four producing mines was further increased as from September 16. The total value of minerals produced during the quarter amounted to £2,813,807. This figure, which is subject to adjustment, is roughly £250,000 more than the value of mineral production during the preceding quarter, and also for the corresponding quarter of last year. Increases were mainly in cobalt alloy, copper, and vanadium production, but there was also an increase in the production of manganese ore for local consumption.

Mineral Production, 1939

	July-Sept.	Jan.-Sept.
Gold . . .	1,052 *oz.**	3,485 *oz.*
Silver . . .	6,826 ,,	59,419 ,,
Cobalt alloy . .	20,553 *cwt.*	58,048 *cwt.*
Copper, blister . .	42,579 *tons*	125,270 *tons*
,, electrolytic .	7,525 ,,	22,415 ,,
Manganese ore . .	2,511 ,,	2,957 ,,
Selenium . . .	—	1,277 *lb.*
Vanadium pentoxide .	176·70 *tons*	508·57 *tons*
Zinc . . .	3,045 *tons*	9,290 *tons*
Limestone . .	11,991 ,,	33,134 ,,
Mica . . .	2,293 *lb.*	5,123 *lb.*
Silica rock . .	384 *tons*	3,430 *tons*

* *Estimated.*

Gold.—At the Dunrobin gold mine, owned by Luiri Gold Areas, Ltd., dewatering was continued. During the quarter 6,694 tons of ore were treated, and bullion containing approximately 958 oz. of fine gold recovered.

Copper.—The quantities of ore treated, and blister and electrolytic copper recovered by the Mufulira, Nchanga, Nkana, and Roan Antelope mines during the quarter under review, are shown in the table on p. 635.

Mine.	Ore treated.		Copper recovered.				Copper Content.
			Blister.		Electrolytic.		
	Tons.	*Per cent. Cu.*	*Tons.*	*Per cent. Cu.*	*Tons.*	*Per cent. Cu.*	*Tons.*
Mufulira .	388,918	4·72	14,901	99·40	—	—	14,812
Nchanga .	21,255	4·28	351	99·25	—	—	348
Nkana .	596,428	3·46	10,360	99·25	7,525	99·95	17,804
Roan Antelope	630,536	3·10	16,966	99·47	—	—	16,876
Total .	1,637,137	3·63	42,578	99·39	7,525	99·95	49,840

By-products recovered at the Nkana mine included 3,599 oz. silver and 20,553 cwt. cobalt alloy. The cobalt alloy averaged 41·06 per cent. cobalt and 14·21 per cent. copper, and contained 8,439 cwt. cobalt metal.

The installation of the necessary surface plant at the Mufulira mine, preparatory to the sinking of an up-cast ventilation shaft to the 460 ft. level, was commenced. One of the two new, direct-fired boilers under construction was completed and brought into use towards the end of the quarter.

At the Nchanga mine the sinking of the " A " and " B " inclined shafts was continued ; progress in the former was held up by water, and in the latter by bad ground, but both difficulties were satisfactorily dealt with. Rapid progress was made with development on both the 360 ft. and 480 ft. levels during the quarter, and stoping above the former level was commenced. The pilot mill was started up during August, and by the end of the quarter 21,255 tons of ore had been treated ; concentrates are being sent to Nkana for smelting. The third of the battery of four direct-fired boilers was brought into commission and the fourth boiler was nearly ready for test at the close of the quarter.

At the Nkana mine the Central shaft was sunk to the final depth, as far as the present programme is concerned, of 2,600 ft. The sinking of the No. 1 sub-incline was continued as was also reclamation work.

The headquarters of the Mine Department of the Roan Antelope mine were transferred to the Storke shaft, and the fine new change-houses there were brought into use. The hoisting of ore (from development work) through the Storke shaft was commenced, and the conveyor system for the transport of this ore to the mill was brought into operation. The total distance is over 7,000 ft., and the system consists of four 42 in. wide conveyor belts in series, in addition to a short transverse conveyor from the primary crushers. The estimated capacity is 1,300 tons an hour. The erection of a fifth, direct-fired, Stirling boiler was started.

Zinc and Vanadium.—At the Broken Hill mine 17,251 tons of ore, averaging 20·81 per cent. zinc, 3·3 per cent. lead, and 0·5 per cent. vanadium pentoxide, were treated. From this were recovered 2,061 tons electrolytic zinc, averaging 99·98 per cent. zinc, and 984 tons debased zinc, averaging 99·22 per cent. zinc. The total recovery for the quarter amounted to 3,045 tons, containing 3,037 tons of zinc metal.

The company also treated 14,888 tons of vanadium ore, averaging 1·40 per cent. vanadium. This yielded 176·70 tons fused vanadium pentoxide, containing 221,742 lb. vanadium.

At the new hoisting shaft of the Broken Hill mine the permanent steel head-frame was erected, and the foundations for the permanent electric winding engines put in. The total depth of the shaft at the end of the quarter was 48 ft., of which 42 ft. had been lined with concrete. At the Davis Shaft the 1,085 ft. level pump chambers were completed with pump foundations poured and floors laid. The installation of the settlers was commenced.

Manganese ore.—2,511 tons of ore, averaging 20·01 per cent. manganese, were mined at Chowa for use as a reagent in the production of zinc at Broken Hill.

SIERRA LEONE

The Chief Inspector of Mines reports the following mineral production for the second quarter of 1939 (corresponding figures for the second quarter of 1938 being shown in brackets): crude gold and unrefined gold bullion, 8,955 (7,526) troy oz.; estimated fine gold, 8,238 (6,954) troy oz.; coarse crude platinum, 7 (63) troy oz.; chromite, 2,625 (nil) tons. Figures for diamond production and iron ore exports are not available.

During the quarter the average number of Africans employed in prospecting was 246, in mining 16,030, and in miscellaneous services connected with the industry 313, making a total of 16,589.

The production of gold for July 1939 amounted to 2,599·84 troy oz., of estimated fineness 920; for August 2,046·14 troy oz., of estimated fineness 918; for September 2,659·88 troy oz., of estimated fineness 917.

TANGANYIKA

The following information has been received from the Acting Chief Inspector of Mines regarding mineral production during the third quarter of 1939.

The provisional value of minerals produced in the Territory during the period July to September 1939 was £285,384. This represents an increase of 7 per cent. over the production recorded for the second quarter of the year. Details of exports for the nine months January to September are contained in

the following comparative statement, the figures for values being subject to a final adjustment.

EXPORTS OF MINERALS

	January-September 1939.		January-September 1938.	
	Quantity.	Value (£).	Quantity.	Value (£).
Gold (unrefined bullion) . .	135,017 *troy oz.*	677,065	80,722 *troy oz.*	425,539
Diamonds . .	2,846 *carats*	8,998	2,559 *carats*	2,709
Tin ore . .	246 *tons*	39,636	310 *tons*	41,547
Tungsten ore .	6 *cwt.*	58	50 *cwt.*	466
Salt . . .	3,566 *tons*	22,001	3,186 *tons*	19,743
Mica (sheet) .	24·1 *tons*	—	14·9 *tons*	—
„ (waste) .	4 *tons*	—	10 *tons*	—
Total value .		747,758		490,004

The quantity and value of the gold exported during the nine months is more than one-and-a-half times greater than that produced during the similar period of 1938. With regard to the diamond industry, while the weight of stones exported remains almost unchanged in each period, the value of the gems for 1939 is nearly four times that of 1938. This is due to the discovery in the Shinyanga District of a deposit in which larger stones of good quality were obtained (see also p. 648). A decline in the production of tin and tungsten ores is noted, but mica and salt have shown an improvement. Owing to the time-lag between exportation and realisation of mica stocks, it is regrettably impracticable to record values in terms of sterling in the above statistics.

Gold.—No new mines came into production during the quarter, and most mines continued in full production until the outbreak of war. During September, however, the output fell below that for August, owing to the inevitable dislocation caused by the emergency measures taken in the territory.

The following table records the output and operations of the five largest producers for the period January to August 1939.

	Tons milled.	Tons cyanided.	Troy oz.		Average grade of ore.
			Unrefined gold bullion.	Refined gold.	
South and Central African Gold Mines, Ltd. . . .	19,437	19,437	15,244	8,033	8 *dwt. per ton*
Geita Gold Mines, Ltd.	51,208	51,208	—	15,653	6 „ „
Buhemba Mines, Ltd.	15,199	9,629	8,546	7,452	10 „ „
Tanganyika Central Gold Mines, Ltd. .	16,857	18,079	7,868	5,846	7 „ „
New Saza Mines, Ltd.	13,472	13,472	8,380	5,053	7½ „ „

The operations of the numerous small workers are usually not so well recorded as those enumerated above; consequently accurate comparisons cannot be made. In general, however, the tonnage crushed and treated ranges from 20 tons to 400 tons per month, and the grade of ore from 3 dwt. to 10 dwt. per ton.

The production of gold from placer deposits continues to decline, and it is feared that the incidence of war will deliver the death blow to this branch of the industry. On the other hand, war conditions should cause an increase in the demand for mica, tin and tungsten. If this anticipation is realised, the increase in production of these minerals may offset the decline in placer gold production.

UGANDA

The following report has been received from the Director of the Geological Survey regarding mining activities in Uganda during the period July to September 1939.

Gold.—The gold output has been maintained at a fairly even figure during the last three months, and in fact since April, but the amount shows a decrease of about 33 per cent. compared with that of the same period of 1938.

The lodes of the Busia area near the Kenya border form as yet the only non-alluvial source of gold, and prospection seems to suggest the possibility of finding numerous other small but payable veins in this locality. The area to the north of the present workings, which was declared closed by Government, has been awarded to a local company, who have not yet commenced operations upon it.

Arrangements are now in hand for the working of the mineralised sandstone-masses in western Buhwezhu. Reference to these bodies has already been made in previous quarterly reports. The values are not likely to exceed 2 or 3 dwt. per ton, but the cost of working, on the other hand, will be low. Provisional figures for the exports of gold during the last three months are 3,648 oz., valued at £25,287.

Tin.—Exports of tinstone have kept at much the same level as formerly, and in contrast to gold there are indications that the output may rise.

The deposits of Burama ridge, Ankole, which have been thought worthy of thorough prospecting by members of the Survey, are now being opened up, and eluvial tinstone has been recovered over a strike of some 3,000 yds. The output of tin during the July-September quarter is provisionally given as 92·85 tons, valued at £15,335.

Tantalite.—Prospection of the area in western Buhwezhu, Ankole, which yields tantalite, is proceeding, and new alluvial

occurrences are continually being found; owing to the dense vegetation, however, it may be some time before the reefs are located. It is possible here by means of judicious sluicing and sieving of stream deposits to obtain an extremely clean separation of tantalite-columbite ores, but the percentage of tantalic oxide varies widely even in localities quite close to one another.

Two small shipments of ore have been made from south-west Ankole. One, weighing 0·83 tons and valued at £199, was of the tantalite type, but mixed with much tinstone; the other weighing 2 tons and valued at £480, was of the columbite type.

Wolfram.—The wolfram-bearing veins of the Kigezi district have proved disappointing, and work upon them has been suspended.

Oil.—A site for a new deep well has been chosen near Kibero, Lake Albert, where the hot salt springs occur, and drilling will soon be in operation.

ABSTRACTS AND NOTES

Mining Development of Northern Australia.—Until 1935 geological surveys in Northern Australia (north of 22° S. Lat.) were of a very sporadic nature. In that year, however, the Federal authorities, in conjunction with the Queensland and Western Australian Governments, inaugurated the North Australia Geological and Geophysical Survey, and it is perhaps significant to note that gold production from the Northern Territory increased from £15,000 in 1934 to £110,000 in 1938.

A recent summary of the results of the Survey (from which the following account is abstracted) has been made by the Rt. Hon. R. G. Casey, Chairman of the North Australia Survey Committee (*Chem. Engng. Min. Rev.*, 1939, **31**, No. 372).

Gold

The more important goldfields of the Territory are the Granites, Tanami, Tennant Creek and Pine Creek, which includes Mount Todd.

Granites.—The Granites field is 350 miles north-west of Alice Springs, from which centre access is gained by road. The discovery of alluvial gold deposits and narrow reefs caused a " rush " in 1932, but little development work resulted and, condemned by mining engineers and others, the field was practically abandoned. The Survey examined the field during 1937 and 1938 and found that further testing and development of the deposits would be justified.

Near the Granites, gold occurs along an east-west line 5½ miles long, the central portion being the most important. It contains a few outcrops, but wide auriferous ironstone bodies have been exposed by trenches, etc., at intervals along 15,000 ft., and form a distinctive belt. The ironstone occurs in five sections (aggregating a length of 11,000 ft.) separated by shallow sand drifts.

Development work has consisted of trenching and a few shallow shafts and workings. An extensive sampling campaign was conducted by the Survey, proving gold over widths varying up to 76 ft. The main ironstone formation has not been fully exposed except in a few workings, the average width being 30 ft. of which 20 ft. represents higher grade ore. The sampling indicated that the Golden Shoe-Vee and the Bullagitchie sections contained the highest grade of ore, but the present development is insufficient for a calculation of average grade or ore-reserves to be made. Over a distance of 500 ft. in the Golden Shoe section the grade ranged from 4·5 dwt. to 16·8 dwt. The Bullagitchie section was sampled at four places along 250 ft. and averaged 4·0 dwt. per ton over 30 ft. Samples across lesser widths at the above and intermediate places gave higher values, for example, over 20, 12 and 6 ft. the values were respectively 7·5, 11·7 and 8·7 dwt. The deepest working is a shaft 72 ft. deep in the Golden Shoe section, and at depths of 47 to 72 ft. in this shaft the exposed portion of the lode (72 in.) averaged 4·87 dwt.

Tanami.—The Tanami goldfield, which is 70 miles to the north-west of the Granites, has been worked at intervals for many years. From the Survey's work a slightly more favourable view of the possibilities of the field is justified than appeared probable from earlier reports, but at present the field can be regarded as suitable only for small-scale operations.

Tennant Creek.—The Tennant Creek goldfield is 360 miles north of Alice Springs and 470 miles west of Mount Isa. The gold deposits of this field are associated with ironstone bodies, and since the known bodies are lenticular in shape repetitions at depth were expected. The magnetic method of geophysical prospecting was used by the Survey during 1935, 1936 and 1937, and revealed 36 major anomalies, arising from buried bodies of ironstone not detectable by other than geophysical methods (*Chem. Engng. Min. Rev.*, 1939, **31**, 359). Some are close to outcropping bodies and could be tested and developed from the same workings as the latter. Five anomalies were tested by diamond drilling, and in each case ironstone was intersected. The Peko No. 1 anomaly is the most important because of its proximity (50 to 100 ft.) to the outcropping body and the gold assays in the No. 3 drillhole. These assays

were 5·87 and 2·63 dwt. per ton from the core between 78 and 85 ft. and 170 and 186 ft. respectively, and 14·0 dwt. from the sludge between 160 and 186 ft.

A new field located by the Survey lies some 35 miles south of Tennant Creek and west of the Alice Springs road, and is known as the Wiso field. Quartz reefs were seen during aerial flights, and sampling proved gold in some reefs. The area is deemed worthy of detailed survey and systematic sampling.

Pine Creek.—This is the centre of a large mineralised area, and is 120 miles south-east of Darwin. The principal deposits in the area are of gold, and some have been investigated or are in process of investigation by the Survey. In the Pine Creek area further testing and development are warranted, particularly near the Enterprise mine. In the Brocks Creek field the Howley line of gold-bearing deposits is a long one worthy of investigation. The Brocks Creek field contains extensive alluvial flats, the shallower portions of which were extensively worked in the past, and search for extensions of these is justified. Investigation of the deeper portions of the alluvial flats for possible gold-dredging propositions is also justified.

Mount Todd.—The Mount Todd field, 150 miles south-east of Darwin, contains Jones Bros., Tollis' and Quigley's gold-bearing quartz reefs. The first-named reef has been worked to a small extent only, owing to difficulties in treating the ore, and there has been little development on the Tollis and Quigley reefs.

Jones Bros.' reef is long, narrow and continuous, with payable values occurring along at least 2,100 ft. Samples along this length averaged 11·3 dwt. of gold per ton over a width of 21·5 in. The greatest depth tested is 130 ft. Two or more ore-shoots probably occur, but further developmental work is necessary in order to determine their extent and grade. Quigley's reef, 1½ miles to the north-east, is 3,000 ft. long with an average width of 2 ft. Surface sampling at 100 to 200 ft. intervals averaged 8·7 dwt. of gold over 24 in., but a sample from an adit gave 13·7 dwt. over 20 in. Further development work is warranted on all three reefs.

Arltunga.—The most important centre on the Arltunga field, 60 miles east of Alice Springs, is White Range, where gold was mined between 1897 and 1920, when the railhead was Oodnadatta. The production was 11,673 oz. of gold from 6,753 tons of quartz. Allowing for the grade of reject ore on the dumps the quartz mined contained 18·4 dwt. per ton. Development and sampling are necessary to determine the possibilities of the field at depth.

The country around and to the east of Claraville contains

a large number of short and narrow but rich quartz veins containing gold. It is considered that, given a centrally-situated battery, the Claraville area might give employment to a number of small parties and individuals.

Wolfram

Wolfram deposits occur at a number of places in the Territory notably at Yeuralba, 190 miles south-east of Darwin. Aerial photography and ground reconnaissances of the Hatches Creek and Wauchope Creek fields, and certain portions of the Murchison and Davenport ranges have been carried out. This district offers possibilities for the discovery of further wolfram and other lodes. At Wolfram Hill in the Pine Creek district, further shoots of wolfram ore may be found.

Mica

The Harts Range mica-field is 150 miles by road from Alice Springs. The mica, which is of the white type (muscovite), and of good quality, occurs as irregular "books" ranging up to 4 ft. square in pegmatite dykes containing massive quartz and felspar, and the field has distinct possibilities. Several claims are at present producing mica, some being equipped with compressors. Mica requires careful mining methods and some technical knowledge in cutting and marketing. At present most of the mica produced is being used in Australia, but greater production should be possible and might obviate the necessity for importation, either as raw material or in manufactured form. The total production from 1873 to May 1939 has been 330 tons, valued at £110,000. During 1937-1938, 50·75 tons, valued at £6,960, and during 1938-1939, 31·71 tons, with an estimated value of £12,133, were produced.

Future Work

The Survey is at present carrying out a general examination of the various areas photographed in the Pine Creek district. Work has begun on the northernmost areas, e.g. Brocks Creek, Mount Tymn, Bridge Creek, Howley Creek, and others such as Golden Dyke and Fountain Head will probably also be surveyed during 1939.

The Geology and Mineral Deposits of the Oliphants Hoek Area, Cape Province.—A report under the above title has just been issued by the Union of South Africa Department of Mines as an explanation of Sheet No. 173, in which the Geological Survey mapping of the district is given in detail. The area in question is situated in the northern part of Cape Province, Oliphants Hoek, the only village, being 150 miles west-north-west of Kimberley. Motor transport facilities in

the northern and western portions of the area operate on the main road between Postmasburg and Kuruman *via* Oliphants Hoek, and the road from Winton connects with the main road from Kuruman to Oliphants Hoek. The eastern portion of the area is traversed by the main road between Kuruman and Koopmansfontein station and by minor divisional roads which give access to Danielskuil and Khosis. Lohathla station, the northern terminus of the railway extension from Postmasburg, is near the southern boundary of the area and about 25 miles east of Oliphants Hoek.

The principal minerals of economic value found in the area are crocidolite asbestos, iron ores and manganese ores, the deposits being dealt with at considerable length in the report. Other minerals described include limestones, jasper, ochre, and building stones.

Crocidolite.—The crocidolite deposits are restricted to the Lower Griquatown stage of the Pretoria Series of the Transvaal System. They take the form of interbedded cross-fibre seams, several being usually found in a working face. The seams are comparable to thin lenses, the length and width of which are many times their thickness. Very often a seam will gradually die out, sometimes in a few feet, but in other cases it may persist for many yards before petering out, when, as a rule, a second seam will arise at another point in the section, and so carry on the fibre continuity.

In the case of crocidolite proper the colour is invariably blue in fresh seams varying from pale lavender to dark steely blue. Pale lavender colouration often goes with high fleeciness, while dark coloured seams often exhibit a more stringy consistency. Variations from the normal uniformly blue variety are not uncommon. Such variations take the form of changes in colour, the lavender blue material passing into pale yellowish or rusty brown phases.

At Mansfield, which lies some 22 miles to the south of Kuruman, there are two main workings. Both occur in the same valley and are now abandoned. Mansfield No. 1 has three distinct fibre horizons parallel to one another and conforming to the dip of the associated banded ironstones. The main underground workings are on No. 2 level and have a thickness of approximately 8 ft., showing from 40 to 55 interbedded cross-fibre seams of blue and yellow fibre closely spaced together. The length of the fibre ranges from a mere fraction of an inch up to 1½ in., the total being in the neighbourhood of 9 in. No. 1 level has 14 seams, the fibre-length ranging from one-eighth to five-eighths of an inch, with a maximum of 2½ in. At Mansfield No. 2, which is situated on the other limb of the anticline, there are also three fibre horizons.

At No. 1 workings at Bretby a shaft 25 ft. deep carries payable asbestos in the lower 5 ft. The seams, which vary in number and thickness, appear to be concentrated roughly in certain horizons separated by 5 to 20 ft. of barren ironstones.

In the western hills asbestos has been proved over a long strike, but most of it appears to be unpayable, although it is possible that rich patches exist. Only the East Mine is operating to-day in a very small way, while the nearby Centre, Salamander and Red Hawk mines are all idle although they appear to have been active at one time.

Since seams thicken or peter out, it is impossible to predict what payable quantities await exploitation behind a promising face exposed in a mine. The length of fibre of individual seams, as well as the total recoverable lengths within a given stoping, are important economic factors. It has been reported that fibre over $\frac{3}{4}$ in. does not average more than 10 per cent. of the output of the whole asbestos belt.

Iron Ore.—Wherever outcrops or hills of Blinkklip breccia are found, bodies of excellent Blinkklip haematite ore may be expected. The ore invariably forms the highest points on the hills and caps the more siliceous breccia below, but many hills have no capping of ore, since, apparently, erosion has left only the lower siliceous portions.

As a rule the haematite ore itself shows little brecciation, compared to the completely fractured rocks below which are always more siliceous. Roughly rectangular blocks of ore are usually tilted at all angles, or are broken into angular blocks varying from a few inches to several feet in diameter. Specularite scales in aggregates, veins, and vugh-like bodies are more characteristic of the siliceous Blinkklip breccia than of the massive haematite ore in which specularite-filled cavities are usually small and lenticular in shape. The haematite surrounding these vugh-like bodies is very fine-grained and massive in contrast to the rather coarsely crystalline scales of the specularite. The haematite ore is black to bluish-black in colour, while freshly fractured surfaces are steel-grey with minute scintillating surfaces representing the reflections from the tiny scales of haematite composing the rock.

From the structure of the Blinkklip hills it is clear that the ore has a limited vertical persistence, the ore in sight representing approximately the total available reserve. Mining conditions are rendered easy by the fact that the ore is well-exposed on the tops of the hills and that it is often parted and broken into blocks of convenient size. Open-cast quarrying without any timbering or driving is all that is necessary, as much of the ore is already broken up and can be transported by gravity to a convenient loading station lower down the hill.

The conglomerate type of ore is restricted to the Gamagara rand. In the south it rests on dolomite, but from Mokanning northwards it overlies chert breccia or banded ironstones or iron ore of the Blinkklip type. The richest ore, which is practically pure haematite, tends to break into roughly rectangular blocks seldom exceeding a ton in weight. The vast majority are considerably smaller, although occasional masses and blocks weighing 50 tons or more are encountered.

These iron ores contain no manganese, but there is a considerable amount of manganiferous iron ore, grading into ferruginous manganese ore, along the Gamagara rand south of the farm Mokanning. More than 50 different occurrences of pure iron ore have been mapped, the estimated reserves amounting to nearly 60 million tons. The quality of the ore is high, the iron content ranging from 61 to 69 per cent.

Manganese Ore.—Manganese ore is found in the Postmasburg area (1) along the Gamagara ridge, (2) in a series of detached hills comprising the Klipfontein ridge, and (3) on some of the prominent solitary kopjes or low rises which are outliers of the rocks building the main ridges. Of these occurrences the last mentioned are only small irregular patches of ore, far apart, and of little economic importance. The most important deposits are those of the Gamagara and Klipfontein hills.

Two types of ore are known ; a siliceous ore, occurring in chert breccias which are most typically developed in the Eastern or Klipfontein belt, and a ferruginous ore, which contains mainly ferruginous impurities and is restricted to the Western or Gamagara belt.

Sporadic and very discontinuous bodies of the siliceous type of ore occur in the chert breccias which are invariably found between the Blinkklip masses and the practically undisturbed dolomite. This ore may, therefore, be expected wherever hills of Blinkklip breccia are found, and is most typically developed in the " Eastern belt " or Klipfontein range of Blinkklip hills. It is, however, by no means restricted to this belt, being found to a smaller extent along the Gamagara rand or "Western belt " as well.

Workings have shown that the ore bodies are highly irregular in shape and size. The ore occurs as a series of disconnected irregularly-shaped bodies ranging in size from narrow veins or pockets up to large masses capable of yielding a thousand or more tons of rich ore.

From Mokanning northwards to the Gamagara loop, the manganese is almost entirely of the siliceous type and is associated most frequently with cherty breccias. The large bodies of ferruginous conglomerate are rarely manganiferous in this part of the area. North of the Gamagara loop the

siliceous breccia is mostly barren, and siliceous manganese is only found on the southern portions of Lilyveld, Bruce and Sishen.

The ferruginous type of ore occurs as lenticular or sheet-like bodies intercalated with basal conglomerates or shales. When associated with the latter it has a laminated or bedded structure and a distinct cleavage.

By far the greatest quantity of manganese in the area mapped occurs on the ridge which extends through Bishop, Morokwa, Lohathla and Lomoteng. All this manganese, much of which appears to be of good quality, rests on the dolomite and is developed in the ferruginous conglomerates, grits and shales.

The manganese ore of the Postmasburg region takes the form of two or more of the oxides of manganese. There are two principal varieties, one massive and the other crystalline, which may occur separately but are generally intimately associated with one another. Occasionally the ore has a banded appearance due to alterations of bright crystalline and duller massive varieties, which, as a rule, form dense compact bodies without structure other than jointing, though sometimes a banding, lamination or breccia structure is observed. Both crystalline and non-crystalline ore occasionally contain irregular cavities which may be lined or filled with other minerals. Both varieties of ore are hard and tough. On being quarried no crumbling or pulverisation takes place, but the whole can be broken into compact lumps of convenient size, while practically no fines and dust are produced. Furthermore, the ore reveals no tendency to disintegrate under the influence of weathering. Outcrops either lie flush with the ground or rise into low hummocks, the weathered surface usually presenting a smooth or polished appearance.

According to its physical properties and approximate chemical composition, which is variable, the massive type of ore approximates most closely to the manganese mineral psilomelane, while the crystalline ore closely parallels the Indian crystalline ores in composition, and is apparently a mixture of crystalline manganese minerals.

The ore is generally of good quality and analyses have shown it to contain from 44 to 52 per cent. of manganese.

The ores naturally vary from point to point. Analyses show that in the ferruginous type of ore, SiO_2 generally varies from 2 per cent. to 4 per cent., and Fe from 8 per cent. to 25 per cent. or more, grading into iron ore. In the siliceous type of ore, SiO_2 varies from 2 per cent. to 10 per cent. or more, and Fe from 4 per cent. to 8 per cent.

Owing to the extremely erratic occurrence and discontinuity of the manganese-ore deposits it is impossible to give any

reliable estimates of the probable or even possible reserves of ore. The tonnage worked out for the area around Bishop trigonometrical beacon gives some idea of the amount of ore available in this small area. By careful measurement of the extent of outcrops only, and taking a low arbitrary thickness, this locality was found to possess approximately 3,200,000 tons, and the adjoining part of Morokwa 200,000 tons of saleable and readily accessible ore, but nowhere north of Bishop is the ore developed to the same extent, so that the rest of the area cannot be judged in the light of the findings on Bishop. The manganese ore is often found in potholes both along the Gamagara rand and on the breccia hills, and many thousands of tons of high-grade ore can often be taken out of a local sink in the dolomite, despite perhaps the unpromising nature of the outcrop on which the workings were sunk in the first instance. The reserves of ore may therefore be much larger than appeared to be the case during preliminary exploration work.

Limestones.—The most extensive limestone exposures occur north of the Gamagara rand and extend from the Gamagara loop eastwards as far as Kathu. To the east and some distance north of Kathu they become concealed under sand but probably persist for at least fifty miles, right down to the Kuruman river. Smaller exposures in the north-central, sand-covered portion of the area are encountered in many localities.

The thickness of the limestone deposits of the area varies between wide limits and may be anything up to 90 ft. or more. Analyses show that the lime content compares very favourably with that of limestones worked in other parts of the country and that the percentages of magnesia and silica, although very variable, are sufficiently low to allow these deposits to be utilised industrially as a flux or in the manufacture of cement, etc. Considering the extent and thickness of the deposits it is obvious that considerable reserves are available for exploitation. Unfortunately, the lack of local demand and the distance from industrial centres and rail-head greatly reduce the present economic value of the deposits which are locally used only as road-metal and building stone.

Dolomitic limestones, apart from their use as building stones, are used as road-metal and as a source of " blue lime." They are also used as a flux in iron furnaces and as a substitute for magnesite in the manufacture of refractory bricks.

Jasper.—Brown jasper occurs in practically unlimited quantities as the predominant component of the Lower Griquatown stage. The greenish and red varieties are confined to the Ongeluk lavas and are of much more restricted distribution.

Ochre.—Ochre occurs as a weathering product of mudstones of the tillite zone as well as of the tillite itself. The material is apparently of low grade, and it is doubtful whether it will be exploitable.

Building Stones.—Dolomite and surface limestones are used locally as building stones, but other rocks which find a similarly wide local application for this purpose include the fissile, flaggy ironstones of the Lower Griquatown stage, the Griquatown tillite and the flagstones of the tillite zone, the Ongeluk lavas and the quartzites of the Gamagara and Matsap series. Since the properties of these rock types have as yet not been investigated scientifically it is impossible to express an opinion about their suitability for the architectural industry. The same applies to the highly aluminous, sectile shales of the Gamagara series. In their chemical composition and at least some of their physical properties these rocks correspond very closely to the "Wonderstone." They may, therefore, be found suitable for an equally wide range of applications in industry. Locally they are used for tombstones.

Geology of the Shinyanga District, Tanganyika.—The Shinyanga District of the Central Plateau of Tanganyika is described in the recently published "Explanation of the Geology of Degree Sheet No. 18 (Shinyanga)," by G. J. Williams and N. W. Eades.

The area comprises part of the slightly-dissected Tertiary peneplain which has reached the level of the summit of the granite batholith, and therefore only the deeper roof-pendants of metamorphic rocks belonging to the Upper Division of the Basement Complex are exposed.

Both the general and economic aspects of the area under review have been described in other publications of the Geological Division, and whilst these are recapitulated briefly, the present work deals more essentially with the advances which have been made in the study of the genesis, petrography and age of the superficial deposits and soils, which are locally important. The mineral deposits of the area are sparse and mining is unlikely to supersede the agricultural and pastoral pursuits of the region. The soils include a considerable variety of loams, marls, sands, calcareous soils, clays, etc., and that each of these is suitable for a particular crop is recognised by the natives who have a surprisingly rich vocabulary of soil names.

The only exploitable mineral is diamond, which originates in kimberlite bodies. Only one detrital deposit, on the northern slopes of Kisumbi Hill, is sufficiently large to be worked.

Prospecting in the metamorphic belt has revealed the occurrence of gold in a number of localities, but in no case

has the grade been found to be sufficiently high to warrant development.

Water supply is important in this thickly-populated district, and this supply is adequately derived throughout the major part of the area from the sandy beds of the streams. In other parts, drill holes have been sunk, the most successful deriving water from bed-rock rather than from the base of the Tertiary deposits.

The well-printed degree sheet itself, on a scale of 1 : 250,000 (3·946 miles to 1 in.) bears testimony to the careful mapping and field work which the authors have carried out with the aid of the Colonial Development Loan (1935).

Gold in the Rupununi District, British Guiana.—A recently published report describes the work of an expedition by D. R. Grantham to the Marudi mountain district, Rupununi, carried out under the aegis of the League of Nations' Mission for Assyrian Settlement at the end of 1934.

The area is composed of granites and gneisses which outcrop more frequently to the south as pavements and small domes of bare rock, the rises being covered with quartz or quartzite. Marudi mountain appears as a flat cone, 750 ft. above the surrounding country, and is cut up into a series of steep-sided ridges. Four miles to the south, Bat Mountain rises 500 ft. above the general level, as a bare, steep-sided granite dome. The Marudi mountain area is composed largely of intensively metamophosed sediments, but the highest ground is occupied by hornblende schists and epidiorites. The most prominent features of the Rupununi-Marudi mountain district, however, are the masses of quartz of all types comparable with the quartzitic rocks associated with gold in the Kaburi District and with the siliceous rocks of the Itaki District.

Prospecting has shown that the richest auriferous area is on the steep slopes of the Marudi mountain, but payable values end with the flattening of the slopes at the base of the mountain. Both metamorphosed sediments and the epidiorites seem to carry gold equally. In the alluvials and eluvials, values of 1 oz. per cu. yd. in Crab Creek, and ½ oz. per cu. yd in Locust Creek, as well as occasional nuggets up to 10 oz., have been recorded. Most of the Marudi Mountain gold is coarse and unworn ; the finer gold has remarkably fresh pitted surfaces, and therefore most probably originates in the vicinity from mineralised country-rock rather than from veins. The author concludes from the above findings that the alluvial deposits are rich but limited in extent, whilst the occurrence of gold in veins and in quartzite shows that the development of deep mining is by no means improbable.

In addition to gold, monazite, xenotime and hussakite

were found in the concentrates, but in no case were large deposits of these minerals encountered.

Zircon, Ilmenite and Monazite Mining in India.—Travancore State in the south-west of India is well known as the locality from which comes the bulk of the world's supply of ilmenite, having to date furnished close on 900,000 tons of this mineral, in addition to large quantities of the accompanying minerals, zircon and monazite. The situation, nature and working of the deposits and the industrial applications of the minerals are described by G. H. Chambers in the issue of *Foote-Prints*, 1939, **12**, No. 1, pp. 1-11.

Zircon, monazite and ilmenite are minerals found in granites and other igneous rocks and are all extremely resistant to weathering, so that on the decomposition of the enclosing rock they are carried down to the sea by rivers and deposited in the form of beach sands. The topography of the Travancore area is particularly favourable for such deposition since there are numerous rivers which, on reaching the coast, spread out into lagoons. The heavier minerals are carried down, deposited on the beaches and continually subjected to sorting and concentration by wave action.

The proportions of the minerals vary considerably from place to place and, between the productive areas there are long stretches of almost barren sand. At present deposits are being worked in two main areas, of which that near Quilon produces the highest grade of ilmenite, while to the south are a number of scattered areas in which monazite is the more important mineral.

In both districts the crude black sand is gathered not only from the beach but also from highly concentrated layers under sand-dunes some distance behind the beach. The dune concentrations are believed to be the result of wind sorting, while the beach deposits have been concentrated by wave action. After digging out, the sand is transported to the concentrating mill, where it is screened, dried and most of the ilmenite removed by electro-magnetic separators. Wet and dry tabling are employed to separate the other minerals, the most abundant of which are zircon, monazite, rutile and garnet, further purification being obtained by the use of electro-magnetic separators.

Ilmenite, zircon and monazite are marketed but, up to the present, little has been done with the other minerals. The rutile has been tested and small quantities shipped to the United States, but in the case of the garnet, although moderately large quantities are available, the grains are water-worn and not so valuable for abrasive use as crushed and graded garnet obtained from rock.

The *ilmenite* from the Quilon area is the highest in TiO_2 of any commercial deposit in the world, a typical analysis being TiO_2, 60·35; Fe, 22·69; SiO_2, 0·41; S, 0·01; P, 0·03 per cent. The rapid growth of Indian ilmenite production is due principally to the expansion of the titanium pigments industry, although a large quantity of the mineral is employed in the manufacture of ferro-titanium. As evidence of the extent of the titanium pigments industry in the United States it is estimated that in 1937 sales amounted to 126,000 tons, of which about two-thirds went into paints, the remainder being used in paper, rubber, floor coverings, leather, etc.

The *monazite* sands were discovered in 1909 and production started in 1911. Since 1918 India has been the principal producer. A recent analysis of the monazite gave the following result: thorium dioxide, 8·3; cerium and other rare earth oxides, 61·7; iron oxide, 0·1; phosphoric anhydride, about 29·0 per cent. Monazite is used as the source of thorium nitrate, an essential constituent of the incandescent gas mantle, and this industry formerly consumed large quantities of monazite. With the wider application of electric light, however, production fell away for a number of years, but more recently an increased demand has been caused by the development of new uses for the mineral. These include the manufacture of ferrocerium (the pyrophoric alloy employed as a "flint" in cigarette lighters) and other cerium alloys, the use of cerium in compounds for proofing cloth against mildew, as a colouring agent in topaz-yellow glass, as an arc stabilizer in carbon arc lamps and as an opacifier in enamel. Present annual exports from India amount to about 2,500 tons.

Exports of *zircon* from India in recent years have also been on the increase, though the figures are somewhat irregular, probably as a result of competition from Australian deposits. During the past few years Indian exports have averaged about 2,650 tons annually. An average analysis of a number of shipments gave the following result: ZrO_2, 66·8; SiO_2, 31·5; TiO_2, 0·84; Fe, 0·08; P_2O_5, 0·07 per cent. The uses of zircon are principally in the manufacture of refractory crucibles, special porcelains for insulators, refractory cements, and heat-resisting glass. Zircon is also the principal raw material for the manufacture of zirconium oxide and salts, the most important of which are the zirconium opacifiers which are now supplanting tin opacifiers in enamels, particularly in the United States. Zirconium metal is used in photoflash bulbs, radio valves, ammunition primers and spot-welding electrodes.

An interesting aspect of the Indian industry is the close association of the most primitive working methods with the most modern electrical equipment. No mechanical equipment

is used in digging out and transporting the sand, but in the concentrating plants complex electro-magnetic and electrostatic separators are employed. The reason for the employment of manual methods where possible is the low cost of native labour.

Uses of Industrial Diamond.—An article on industrial diamond was published in this BULLETIN, 1936, **34**, 458, and further information on the subject has appeared in *Mineral Trade Notes*, 1939, **9**, No. 2, pp. 13-15. According to this account, only about one quarter of the diamonds mined throughout the world in 1938 were classed as gemstones, the remainder being put to industrial uses. Because of its extreme hardness the diamond is unsurpassed as a cutting agent, and for many years the Brazilian black diamond or carbonado was the leading diamond used in rock drills and for other grinding and cutting purposes. During recent years, however, diamonds of gem type, but of a quality unsuited for ornamental purposes, have largely replaced carbonados. In rotary drilling a 50 per cent. saving in costs is said to be effected in this way, and while in 1929, 42·5 per cent. of the diamonds used in Canadian drilling operations were carbonados, in 1935 the percentage was only 4·5.

Recent practice has resulted in the use of smaller and smaller diamonds, and even diamond dust. Certain drill heads are now made by adding up to 20 per cent. dust or small diamonds to the powdered metal, and the mixture is then sintered to a solid mass. In recent years in Canada diamond drills have been used for stoping purposes as well as prospecting purposes, to which their use was previously confined.

Industrial diamonds are also used in the tips of diamond tools for truing abrasive wheels, shaping automobile and aeroplane engine parts and for similar purposes. The increasing use of extremely hard alloys such as tungsten carbide has resulted in increasing rather than diminishing the use of diamonds as they are necessary in shaping the alloys, though the latter have replaced diamonds to some extent in cutting tools. In Europe in 1933, and in the U.S.A. in 1934, abrasive wheels, in which small borts or diamond dust are embedded in tungsten or some other medium, were introduced. They are said to cut much faster and to last longer than other abrasive wheels.

Industrial diamonds are also used for glass cutting and for making diamond dies for wire-drawing. Diamond dust is now used extensively in bonded wheels and tools, but its widest use is in sawing and polishing diamonds, other gemstones, etc. It is essential in producing bearings for precision instruments and in polishing tungsten carbide tools. It may be

used with oil on a " lap " for cutting and polishing gemstones, or may be beaten into circular saws of phosphor-bronze, brass, steel or copper, or it may be fed to such wheels as they rotate. It is also used with wire saws or is fed to drills used in piercing diamonds or other hard substances.

Other uses include diamond-set teeth on circular saws for stone cutting, atomizers used in oil-burning furnaces, gramophone needle points, and pivots and bearings of delicate instruments.

Consumption of industrial diamonds has more than doubled during the past four years, because of the increasing number of uses.

Modern Uses of Limestone and its Products.—Until quite modern times, the use of limestone was almost exclusively in building construction, but, particularly within the last sixty years, it has found increasing application in many chemical and metallurgical industries. These numerous and in many cases indispensable uses have recently been summarised by M. F. Goudge (*Canad. Min. Metall. Bull.*, 1939, No. 330, pp. 521-526) in a general survey of limestone as a raw material, with special reference to the large Canadian industry which has grown around this product.

To realise the indispensability of limestone to modern industrial activities it is only necessary to consider the number, diversity, and importance of the manufacturing processes into which it enters as a raw material. The iron and steel industry could not exist without large supplies of limestone. Limestone and lime find important applications in the metallurgy of nickel, lead, copper, chromium, zinc, tin, gold, silver, antimony, cobalt, molybdenum, and other metals,—limestone as a flux, and lime principally as a reagent in flotation, cyanidation, and amalgamation processes. Limestone is indispensable to the present-day pulp and paper industry. It is also the principal raw material in the manufacture of cement, rock-wool, and calcium carbide. In the manufacture of soda-ash by the ammonia-soda process, about 1¼ tons of high-calcium limestone is used per ton of soda-ash produced. The glass industry requires limestone for many of its products. Large quantities are used in the refining of beet sugar. Limestone plays a vitally important part in agriculture, for calcium is one of the elements essential to plant and animal life. Pulverised limestone (and lime) is spread on acid farm-land to sweeten the soil; it is an ingredient of many stock and poultry foods; it is used in the manufacture of many nitrogenous fertiliser and fertiliser materials, such as calcium nitrate, cyanamide, ammonocitrophosphate, calcium ammonium nitrate, and ammonium sulphate, and also as a filler in other chemical

fertilisers; lime is largely used in the compounding of fungicides and insect poisons. Limestone is widely employed in the construction industry; it is one of our principal building and decorative materials; as crushed stone, it is used in enormous quantities for road metal, concrete aggregate, and railway ballast; the uses of lime in mortar and as a plaster are known to all. Lime plays a part in the preparation of many food products such as baking powder and baking soda, gelatine, glucose, dextrin, and saccharin. It is also used in the manufacture of citric, tartaric, and other organic acids. Pulverised limestone is employed as a neutralizing agent in the making of yeast, wines, and lactic acid. Lime and limestone find applications in the making of building brick and pottery, silica brick, and sand lime brick. Lime is a valuable enamel constituent in that it increases the opacity of the enamel. Either in the raw or calcined state, limestone is used in the textile and leather industries, the paint and varnish industries, the petroleum industry, the hardwood distillation industry, the rubber industry, and many others. In the rubber industry, it is of interest to note that, in addition to being used in the compounding of natural rubber, limestone is one of the principal raw materials from which synthetic rubber is prepared. A great many other uses of limestone could be mentioned, particularly in chemical processes, but those enumerated will serve to indicate the important part that limestone plays in modern industry.

Variety in the resources of limestone is an important factor in so far as utilisation is concerned. Hard, tough, siliceous limestone is preferred for the making of road metal and railway ballast. Argillaceous limestone, having a low content of magnesium carbonate, is utilised in the Portland cement industry. Argillaceous, magnesian limestone is desired for making rock-wool. The glass industry can use siliceous limestone provided the iron content is low. For most chemical and metallurgical uses, however, pure limestone, generally of the high-calcium variety, is preferred. Furthermore, where the limestone is to be used in its calcined state, it should be free from such impurities as would make the lime dark in colour, because white lime is necessary in many processes and for many products, especially food products.

The great proportion of limestone products, ranging from flux stone of various sizes down to granules for poultry grit and for use in roofing products, require careful crushing and screening. The pulverised products must also be very carefully prepared to conform to stringent specifications regarding fineness. Recent years have witnessed an increasing demand for washed stone and also for a greater variety of products, necessitating very close sizing. To meet these demands, the

producers have had to add the most modern equipment and to exercise their ingenuity to the full in order to maintain the necessary flexibility in their plants. The economic disposal of very small-sized stone and dust resulting from the crushing and screening operations has always been a problem in the past, but there is now an increasing demand for products made from these quarry fines. With additional screening and pulverising, the fines are being marketed for agricultural use, for stone sand (in districts where natural sand is not available), for rock dusting of coal mines, for asphalt filler, for fillers in the rubber, linoleum, oilcloth, paint, and other industries, and also for incorporating into stock and poultry foods. The production of granules from white and attractively coloured limestones for use as terrazzo chips, stucco dash, poultry grit, roofing granules, and the like, has become a specialised branch of the limestone industry.

In the lime industry noteworthy developments are occurring. Until recent years, there was only a very small market for carbon dioxide, and the gas evolved during calcination of limestone has been allowed to go to waste. With increasing demand for carbon dioxide for use as a refrigerant, as an explosive, in chemical processes, in carbonated beverages, etc., ways and means of recovering carbon dioxide from lime kilns have been devised, and it is now being marketed in solid and liquid forms from one lime plant in Australia and from another in the United States. Equipment is also in use in several places for recovering carbon dioxide from dolomite, leaving lime as a by-product. If the recovery of carbon dioxide becomes a more general practice, as would seem likely, it would probably tend to decrease the cost of making lime, which, in turn, would encourage its greater utilisation.

One of the greatest potential uses for limestone is in agriculture. Though the necessity of applying limestone or lime to agricultural lands, in order to replace the vitally important calcium compounds that are continually being removed by cultivation and cropping, has been emphasised for years by authorities on agriculture, the quantity so used by farmers is still comparatively small, whereas if the proper quantities were applied, the amount would constitute one of the most important items of limestone production and, at the same time, would solve the problem of finding uses for quarry fines.

Developments in the production of elemental magnesium, which is rapidly assuming a position of importance among the industrial metals, indicate that dolomite may possibly replace magnesite as a principal raw material for its manufacture. Hitherto, magnesium has been manufactured almost entirely by the electrolytic process, using magnesite and magnesium

chloride brine as the raw materials, but of late the electrothermic process has come rapidly to the fore, and most new plants to be built will employ this latter process. With this process, dolomite can be used as the raw material and is being utilised in countries where magnesite is lacking or difficult to obtain.

Many other prospective uses for limestone in chemical, metallurgical and general manufacturing can be instanced. These, taken in conjunction with the probabilities of increased demand in the future for many products in the making of which limestone is currently utilised, would seem to assure a future position of even greater importance for limestone as an industrial raw material than it occupies at present.

Chalk for Underground Use.—In *South African Mining and Engineering Journal*, 1939, **50**, Pt. 2, p. 15, there is an interesting description of one of the secondary industries which have been established in connection with the mining industry in the Union.

Some 30 or 40 tons of chalk are required every month for marking purposes in connection with blasting and other aspects of development work. All this is now manufactured in South Africa from indigenous raw materials, replacing the previous imports of lump chalk. Most of the chalk used is made by four concerns, each having its own process. In one of these the chalk is made by hand in rubber moulds, though steel moulds are employed by other concerns.

The gypsum and other ingredients are mixed by machine, poured into the moulds and allowed to set for about 15 to 20 minutes. The sticks, held in position in boxes by wire netting, are dried in the air for several days. The average stick is 6 in. long, 1¾ in. in diameter, and 8 oz. in weight, and they are packed in boxes of one hundred. Climatic conditions are important, especially as in hot weather the sticks are liable to be burnt by the sun, which makes them brittle. While this industry is not large at present, the demand for chalk is likely to increase as new mines come into production.

Metal Polishes and their Raw Materials.—In an article in *Chemical Age*, 1939, **40**, 448-450, G. S. Collingridge reviews the progress in metal polishes and their raw materials during the last twenty or thirty years. During this time there has been little fundamental change except that liquid polishes have largely replaced pastes and "putz" pomades, and that brass polishes containing coarse abrasives have been replaced by silver and chromium polishes, characterised by the greater fineness and more uniform size of the particles. In addition, a wider range of raw materials is available.

So far as the abrasive constituent of the polish is concerned, the following have been used: pumice, emery powders, kieselguhr, silica, amorphous silica, white siliceous earths, precipitated and prepared chalks, precipitated calcite, tripoli, bentonite, china clay, whiting, putty powder, aluminium oxide, chrome oxide, tin oxide, common salt, Fuller's earth, calcium phosphate, rouge, and heavy magnesium carbonate. Of these silica in a ground crystalline form and pumice are the most widely employed.

Apart from the abrasive, the choice of soap, detergent and vehicle is of importance in deciding the constituents of a particular polish. The soaps used are ammonium oleate and linoleate, potassium oleate, triethanolamine stearate and oleate, sodium sterolate and oleate, ordinary hard soap, soap flakes and soap powder. The detergents include paraffin oil, oxalic acid, sodium carbonate, trisodium phosphate and tetrasodium pyrophosphate. The soaps act as detergents, emulsifying agents and as mechanical buffers to modify the abrasive action. In modern polishes it is usual to stabilise an aqueous suspension of the abrasive with ammonia soap, produced *in situ* with the addition of excess ammonia.

Of the detergents paraffin oil has the advantage of being cheap and acts as a grease solvent, but is liable to smear and spoil the lustre; oxalic acid is toxic; the alkalis are useful as they aid in the emulsification of the grease and tarnish film, and make the use of excessive quantities of soap unnecessary.

The vehicle acts as a suspending medium for the abrasives, as a solvent for the detergents, and facilitates the suspension and removal of the debris on the surface of the metal. Water, paraffin oil, naphtha, turpentine and its substitutes are the most common vehicles, while carbon tetrachloride, deodorised kerosene, tetrahydronaphthalene, alcohol, cyclohexanol and methyl-cyclohexanol, steam-distilled pine oil, etc., are also used.

A typical old-fashioned polishing paste consisted approximately of tripoli 20 lb., petroleum jelly 4 lb., Japan wax 1 lb., kerosene 3 pts., naphtha 1 pt., and oleic acid 2 pts. This had the disadvantage of being greasy and hard to manipulate, although a satisfactory lustre could be obtained with prolonged rubbing. A satisfactory alternative, comparatively free from these disadvantages, would consist of powdered pumice 30 lb., kieselguhr 25 lb., powdered hard soap 1·5 lb., oleic acid 12·8 lb., paraffin oil 30 lb., aluminium stearate 0·2 lb., bleached montan wax 0·5 lb., perfume and colour q.s. A non-inflammable water-base liquid polish might have the following formula: fine grade silica 10 lb., air-floated tripoli 11 lb., colloidal clay 1·5 lb., oleic acid 5 lb., ammonia (25° Bé) 3 lb., steam-distilled pine oil 4 lb., water 65·5 lb.

Metal polishing pads, which have recently been introduced into this country and have been popular in the U.S.A. for several years, are made by dipping Canton flannel into a suitable liquid polish such as: kieselguhr 15 parts, ammonium linoleate 8 parts, glycerine 2 parts, and water 75 parts. After immersion the pad is gently wrung out and allowed to dry away from fire.

BOOK REVIEWS

Books for review should be addressed to "The Editor," Bulletin of the Imperial Institute, South Kensington, London, S.W.7.

DESCRIPTIVE LIST OF NEW MINERALS 1892-1938, containing all New Mineral Names not mentioned in Dana's System of Mineralogy, Sixth Edition, 1892. Compiled by G. L. English. Pp. 258, 9 × 6. (London and New York: McGraw-Hill Publishing Company, Ltd.) Price 18s.

Since the Sixth Edition of Dana's *System of Mineralogy* appeared in 1892, a very large number of new minerals has been described, and the present volume, which contains over two thousand of these names, provides a handy index for those who wish to have all the new mineral names briefly tabulated, defined and described within the compass of a single volume.

The method of presentation is alphabetical, so that the nature of a mineral can be found if its name is known, but unfortunately the converse does not hold. The value of the book would, therefore, have been immeasurably increased if a classification by elements, as in Appendix B of Dana's *Text-book*, had been included.

The information concerning each mineral is presented along lines similar to those in the "Lists of New Minerals" of the *Mineralogical Magazine*. That is to say, references to literature are quoted, followed by the simpler characteristics, such as crystal system, form, colour, hardness, density, composition, chemical formula and the principal localities in which the mineral occurs. Optical data are omitted. The method of abbreviating the references is an irritating departure from standard practice, but with the aid of the key given, no difficulty should be experienced. It may be noted that some of the references are to abstracts and not to original sources.

It is a pity that, in addition to purely scientific names, the author has seen fit to include a number of trade names, such as ardmorite, floridin, glacialite, montasite, sabalite, etc. The

number of similar commercial terms is so great that several separate volumes would be required to include them all, and there seems little point in including a few, chosen at random, in what is otherwise essentially a scientific work.

As this book is of transatlantic origin, English readers will not approve of much of the Appendix on the new nomenclature, in which the spellings of felspar and haematite and the old names fluorspar and mispickel *inter alia*, are discredited. The volume is fairly free from errors (heliodor and ashcroftine are misspelt), and this work forms a notable addition to the standard works on mineralogy.

ELEMENTS OF GEOLOGY. By William J. Miller. Second Edition. Pp. viii + 524, 9 × 6. (London: Chapman & Hall, Ltd., 1939.) Price 21*s*.

The continued popularity of Professor Miller's *Elements of Geology* is attested by the appearance of this second edition after the first had run to three reprints.

In carrying out a thorough revision of the earlier issue, the author has not only incorporated the more recent advances in geology but completely re-selected the illustrations and re-drawn the paleographical maps. A certain amount of re-orientation of subject matter has also been done to arrive at a more logical presentation.

Whilst maintaining its purely North American outlook, even as a general textbook of geomorphology, the work, by reason of its excellent plates and maps, will make ready appeal to students of the stratigraphical dispositions of that continent.

GEOMORPHOLOGY. An Introduction to the Study of Landscapes. By A. K. Lobeck. Pp. xii + 731, 9¼ × 6¼. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 25*s*.

A true appreciation of scenery is not possible without an understanding of some at least of the natural devices which determine the basic form of landscape. The study of these is known, precisely, as geomorphology.

From the outset, Professor Lobeck's volume on the subject makes instant appeal by its profusion of magnificent plates, which serve as the framework for his presentation in the text. The ease with which the photographs can be studied is, however, no indication of the calibre of the letterpress, and though described as "an introductory text" many of the author's short chapters will doubtless pass beyond the comprehension of the budding geologist.

The work is in twenty chapters, the first of which deals with introductory matters such as geomorphology and allied

studies, the geomorphic cycle, and climate, and the second with rocks and their structures. The author then treats of the agents of denudation, weathering, streams, glaciation, marine and aerial effects, and includes a chapter on coralline growths. The remainder of the book is devoted to the geomorphological units resulting from the work of rivers, ice, seas and wind, coupled with terrestrial movements. The last two chapters deal with volcanoes and meteor craters.

This book is one of the best volumes on the subject which has appeared, and by reason of its illustrations, individual chapter questionnaires, extensive bibliographies, and excellent subject index, constitutes a standard work.

A TEXTBOOK OF GEOMORPHOLOGY. By Philip G. Worcester. Pp. vii + 565, 9 × 6. (London: Chapman & Hall, Ltd., 1939.) Price 22*s*. 6*d*.

In this volume the author assumes little or no previous knowledge of geology and has therefore briefly covered the elementary aspects of the approaches to the subject. After the introduction, the author describes the relief features of the earth and considers its place in the solar system, devoting the next two chapters to the elementary facts of mineralogy and petrology. Descriptions of earth movements and structures and of rock weathering follow, and the remainder of the book examines the types of topography produced under varying conditions. The effects produced by streams in humid regions, in semi-arid and desert regions and in glacial regions are described, followed by an examination of lakes and swamps, of shore-forms of seas and lakes, and the effects of ground water. A chapter on vulcanism is followed by one on islands and coral reefs, while the last chapter deals with plains, plateaux and mountains.

An abundance of diagrams and photographs with explanatory notes is interspersed with the text; naturally, these are almost entirely of American subjects. The author has taken pains to summarise any controversial points fairly, and a short bibliography at the end of each chapter makes it possible for the reader to follow up any particular line of enquiry. A comprehensive index completes a volume that forms an excellent introduction to the study of geomorphology.

BIBLIOGRAPHY

Comprising the more important reports, articles, etc., contained in mineral publications received in the Library of the Imperial Institute during the three months, August-October 1939.

The publications issued by the Governments of the Colonies and Protectorates can be obtained from or through the Crown Agents for the Colonies, 4 *Millbank, Westminster, S.W.*1. *Applications for Dominion and Indian Government publications may be made to the Offices of the High Commissioners or Agents-General in London.*

OFFICIAL ANNUAL REPORTS

Northern Ireland: Report on the Mining and Quarrying Industries during the year 1938. Pp. 11, 13 × 8. (Belfast: H.M. Stationery Office, 1939.) Price 1*s*.

Colony and Protectorate of Kenya: The Mining and Geological Department Annual Report, 1938. Pp. 24, 9¾ × 6. (Nairobi: Government Printer, 1939.) Price 1*s*.

Nigeria: Annual Report on the Geological Survey Department for the year 1938. *Sessional Pap. No.* 25 *of* 1939. Pp. 18, 13 × 8¼. (Lagos: Government Printer, 1939.) Price 1*s*. 6*d*.

Rhodesia: Forty-fourth Annual Report of the Chamber of Mines (Incorporated) for the year 1938. Pp. 58, 9½ × 7½. (Bulawayo: Rhodesian Printing and Publishing Company, Ltd., 1939.)

Tanganyika Territory: Annual Report of the Department of Lands and Mines for 1938. Pp. 103, 9¾ × 6¾. (Dar es Salaam: Government Printer, 1939.) Price Shs. 4.

Tanganyika Territory: Annual Report of the Geological Division, Department of Lands and Mines, 1938. Pp. 27, 9¾ × 6¾. (Dar es Salaam: Government Printer, 1939.) Price 1*s*. 6*d*.

Tanganyika Territory: Annual Report of the Mines Division, Department of Lands and Mines, 1938. Pp. 36, 9¾ × 6¾. (Dar es Salaam: Government Printer, 1939.) Price 1*s*.

Transvaal Chamber of Mines: Forty-ninth Annual Report, 1938. Pp. 152, 9 × 7. (Johannesburg: Transvaal Chamber of Mines, 1939.)

Canada: Report of the Mines and Geology Branch for the fiscal year ended March 31, 1938. By J. McLeish. *Dep. Mines Res.* Pp. 48, 9¾ × 6½. (Ottawa: King's Printer, 1939.) Reprinted from the *Annual Report of the Department of Mines and Resources*, pp. 11-59 inclusive.

Mineral Production of Ontario during first six months, 1939. *Bull. No.* 124, *Ontario Dep. Mines.* Pp. 8, 10 × 6½. (Toronto: King's Printer, 1939.)

Alberta: Annual Report of the Mines Branch of the Department of Lands and Mines, 1938. Pp. 108 + viii, 10 × 6½. (Edmonton: King's Printer, 1939.)

British Columbia: Annual Report of the Minister of Mines for the year ended December 31, 1938. Part A. The Mining Industry (Statistical Review). By J. F. Walker. Pp. 53, 10½ × 7½. (Victoria, B.C.: King's Printer, 1939.)

British Columbia: Annual Report of the Minister of Mines for the year ended December 31, 1938. Part B. North-Western District. By J. T. Mandy. Pp. 42, 10½ × 7½. (Victoria, B.C.: King's Printer, 1939.)

British Columbia: Annual Report of the Minister of Mines for the

year ended December 31, 1938. Part G. Inspection of Mines. By J. Dickson. Pp. 48, 10½ × 7¼. (Victoria, B.C.: King's Printer, 1939.)

General Report of the Geological Survey of India for the year 1938. By A. M. Heron. *Rec. Geol. Surv. India*, 1939, **74**, 1-132.

South Australia: Mining Review No. 69 for the half-year ended December 31, 1938. *Mines Dep.* Pp. 107, 9½ × 6. (Adelaide: Government Printer, 1939.)

Fiji: Mining Board Annual Report for 1938. *Council Pap. No.* 11, *Legislative Council.* Pp. 15, 13 × 8¼. (Suva: Government Printer, 1939.)

New Zealand: Mines Statement for the year 1938. By the Hon. P. C. Webb. Pp. 102, 13 × 8¼. (Wellington, N.Z.: Government Printer, 1939.) Price 2*s.*

France: L'Industrie Minérale en 1938. *Ministère des Travaux Public.* Pp. 134, 9 × 5½. (Paris: Bureau de Documentation Minière, Dunod, 92 Rue Bonaparte (VI), 1939.)

MINING LAW

Mexico: Legislacion Petrolera: Leyes, Decretos y Disposiciones Administrativas referentes a la Industria del Petroleo. Tomo Decimoctavo. Pp. 25, 11½ × 7¾. (Mexico: Secretaria de la Economia Nacional, Departamento de Petroleo, 1939.)

COMMERCIAL INTELLIGENCE

The Oil and Petroleum Year Book, with which is incorporated the Oil and Petroleum Manual for 1939. Compiled by W. E. Skinner. Pp. 416, 8 × 5½. (London: W. E. Skinner, 1939.) Price 10*s.* A record of companies interested in the oil industry.

Canadian Mines Handbook, 1939. Pp. 416, 7½ × 5. (Toronto: Northern Miner Press, Ltd., 1939.) Price $1.

The Non-Ferrous Smelting and Refining Industry in Canada, 1938. *Min. Metall. Chem. Br., Canada.* Pp. 17, 11 × 8½. (Ottawa: Department of Trade and Commerce, 1939.) Price 15 cents.

Minerals Yearbook, 1939. Compiled under the supervision of H. H. Hughes. *U.S. Dep. Interior.* Pp. 1,437, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price $2.

The Mineral Industry: Its Statistics, Technology, and Trade during 1938. Edited by G. A. Roush. Vol. 47. Pp. 784, 9½ × 6½. (London and New York: McGraw-Hill Book Company, Inc., 1939.) Price £3 16*s.*

GEOLOGY AND MINERAL RESOURCES

Descriptive List of the New Minerals, 1892-1938. Compiled by G. L. English. Pp. vii + 258, 9 × 6. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 18*s.*

Elements of Geology. By W. J. Miller. Second Edition. Pp. viii + 524, 9 × 6. (London: Chapman & Hall, Ltd., 1939.) Price 21*s.*

Geomorphology. An Introduction to the Study of Landscapes. By A. K. Lobeck. Pp. xii + 731, 9½ × 6½. (London: McGraw-Hill Publishing Co., Ltd., 1939.) Price 25*s.*

A Textbook of Geomorphology. By P. G. Worcester. Pp. vii + 565, 9 × 6. (London: Chapman & Hall, Ltd., 1939.) Price 22*s.* 6*d.*

Geological Factors in the Valuation of Mines. By D. H. McLaughlin. *Econ. Geol.*, 1939, **34**, 589-621.

Factors influencing Mineral Land Values for Assessment Purposes. By R. L. Auchmuty. *Min. and Metall.*, 1939, **20**, 412-415.

Redruth, North Gwennap, and Illogan. By F. J. Stephens. *Min. Mag., Lond.*, 1939, **61**, 83-90, 140-152. A review of early work in an ancient Cornish mining district, and a record of facts which may prove useful in the future.

Mining in Kenya. *Min. Geol. Dep., Kenya.* Pp. 28, 7½ × 9¾. (Nairobi: Government Printer, 1939.) A concise summary of information likely to be of value to those interested in the development of the mining industry in Kenya.

Tanganyika Territory: Explanation of the Geology of Degree Sheet No. 18 (Shinyanga). By G. J. Williams and N. W. Eades. *Bull. No.* 13, *Geol. Div., Dep. Lds. Mines.* Pp. 23, 9¾ × 6¾. (Dar es Salaam: Government Printer, 1939.) Price 2*s.* 6*d.*

Cape Province: The Geology and Mineral Deposits of the Oliphants Hoek Area. By F. C. Truter, B. Wasserstein, P. R. Botha, D. J. L. Visser, L. G. Boardman and G. L. Paver. *Geol. Surv., Union S. Afr., Expl. of Sh. No.* 173. Pp. 136, 9 × 6, and maps. (Pretoria: Government Printer, 1938.) Price 5*s.*

Mineral Production in South West Africa. *S. Afr. Min. Engng. J.*, 1939, **50**, Part 2, 5-7.

South West Africa: The Geology and Mineral Deposits of the Omaruru Area. By S. H. Haughton, H. F. Frommurze, T. W. Gevers, C. M. Schwellnus and P. J. Rossouw. *Geol. Surv., Union S. Afr., Expl. of Sh. No.* 71 (*Omaruru, S.W.A.*). Pp. 160, 9½ × 6, and maps. (Pretoria: Government Printer, 1939.) Price 5*s.*

Report on a Short Visit to Marudi Mountain Gold Workings, Rupununi District, 1934. By D. R. Grantham. *Bull. No.* 13, *Geol. Surv. Brit. Guiana.* Pp. 5, 10 × 7½. (Georgetown, Demerara: Government Printers, 1939.) Price 12 cents.

Mining in the Canadian Shield. By W. L. G. Muir. *Min. Mag., Lond.*, 1939, **61**, 73-78.

The Montauban Mineralised Zone, Quebec. By F. Fitz Osborne. *Econ. Geol.*, 1939, **34**, 712-726.

Lachute Map-Area: Part I, General and Economic Geology. By F. Fitz Osborne. *Ann. Rep. Quebec Bur. Mines for the calendar year* 1936. Part C, pp. 3-40, and map. (Quebec, King's Printer, 1938.)

Lachute Map-Area: Part II, The Lowland Area. By H. W. McGerrigle. *Ann. Rep. Quebec Bur. Mines for the calendar year* 1936. Part C, pp. 42-62, and map. (Quebec: King's Printer, 1938.)

Expansion of the Quebec Metal Mining Industry. By J. E. Gill. *Canad. Min. Metall. Bull.*, 1939, No. 329, 500-520.

Geology of the Brazeau Area, Alberta. By J. O. G. Sanderson. *Canad. Min. Metall. Bull.*, 1939, No. 328, 429-442.

Poland and its Mineral Wealth. *Min. and Metall.*, 1939, **20**, 449-450.

La Spagna Mineraria. *Industr. Min. Ital. Oltremare*, 1939, **13**, 388-392.

Reconnaissance of Placer-Mining Districts in Lemhi County, Idaho. By S. H. Lorain and O. H. Metzger. *Inform. Circ. No.* 7082, *U.S. Bur. Mines.* Pp. 81, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

The Primary Mineralisation at Chuquicamata, Chile, S.A. By V. M. López. *Econ. Geol.*, 1939, **34**, 674-711.

PROSPECTING AND MINING METHODS

(*See also under Metals and Non-Metals.*)

The Problem of Accidents from Falls of Ground. *What Every Mining Man Should Know, No.* 6. Pp. 29, 9½ × 7½. (London: H.M. Stationery Office, 1939.) Price 3*d.*

Metal-Mine Accidents in the United States during the calendar year 1936. By W. W. Adams and M. E. Kolhos. *Bull. No.* 422, *U.S. Bur. Mines.* Pp. 53, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Automatic Mine Pumping with Off-Peak Power at Wright-Hargreaves Mines, Limited, Ontario. By P. Bennett. *Canad. Min. Metall. Bull.*, 1939, No. 330, 435-444.

Interpretation of Leached Outcrops. By R. Blanchard. *J. Chem. Soc. S. Afr.*, 1939, **39**, 344-373.

Re-Forging and Heat Treatment of Jackbits. By F. G. Burns, in collaboration with R. R. McGhiee, F. Larkin and E. Farrer. *Proc. Austr. Inst. Min. Metall.*, 1939, No. 114, 125-152.

Deep Lead Mining Methods. By J. Cock. *Min. Geol. J.*, 1939, **2**, No. 1, 41-42. A description of the Chiltern and Ballarat methods of deep lead mining employed in Victoria.

The Development of the System of Siphons at present in Use for Drainage Purposes at North Broken Hill, Limited. By W. J. Cuming. *Proc. Austr. Inst. Min. Metall.*, 1938, No. 111, 145-153.

Geophysical Prospecting: Its Value in the Canadian Metal Mining Industry. By V. G. Gabriel. *Canad. Min. J.*, 1939, **60**, 474-477.

Geophysics in Exploration at Falconbridge, Ontario: an Introductory Account. By F. McI. Galbraith and R. C. Hart. *Canad. Min. Metall. Bull.*, 1939, No. 330, 527-531.

The Estimation of Ventilation Air Temperatures in Deep Mines. By C. W. B. Jeppe. *J. Chem. Soc. S. Afr.*, 1939, **40**, 1-30.

Underground Mining at Rio Tinto, Spain. By C. R. Julian. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 421, 43 pp.

Points of View on the Rock-Burst Problem. By R. G. K. Morrison. *Canad. Min. Metall. Bull.*, 1939, No. 328, 443-460.

Changes in Mining Engineering, Present and Prospective. By E. L. Oliver. *Min. and Metall.*, 1939, **20**, 405-408.

A New Technique of Boring overcomes Sampling Problems. By O. J. Parker, Jun. *Engng. Min. J.*, 1939, **140**, No. 7, 32-38. Description of a process of close boring employed at the Ora Banda United Mines, Western Australia.

CONCENTRATION AND METALLURGY

(*See also under Metals and Non-Metals.*)

Saving Gold by means of Corduroy. By M. W. von Bernewitz. *Inform. Circ. No.* 7085, *U.S. Bur. Mines.* Pp. 17, 10½ × 7. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

A Cyanide Process based on the Simultaneous Dissolution and Adsorption of Gold. By T. G. Chapman. *Canad. Min. J.*, 1939, **60**, 404-408.

Brick Linings for Rotary Furnaces. By C. C. Downie. *Min. Mag., Lond.*, 1939, **61**, 137-139.

A Scientifically Designed Gold Trap. By A. E. Flynn. *Canad. Min. J.*, 1939, **60**, 537-538.

Reducing Costs in Percolation Cyanidation. By S. B. Hill. *Chem. Engng. Min. Rev.*, 1939, **31**, 397-400.

The Stuerzelberg Process. By H. Hofmeister. *Min. J.*, 1939, **206**, 757-758. A process for the production of iron from calcined pyrites.

Gold Extraction: A Remarkable New Process. By K. S. Low. *Min. World., Lond.*, 1939, **137**, 169. A description of an amalgamation

process in which powdered dry ore is submerged by pressure into the mercury bath.

The Continuous Wide Strip Rolling Mill: Social and Economic Consequences of a recent Development in American Steel-Mill Practice. By E. D. Martin. *Min. and Metall.*, 1939, **20**, 453-457.

Thirty Years of Zinc-Blende Roasting. By A. Pór. *Min. J.*, 1939, **206**, 777-778.

Some Recent Innovations in Canadian Milling Practice. Compiled by B. Robinson. *Canad. Min. Metall. Bull.*, 1939, No. 327, 316-326; No. 328, 361-370.

The Cyanidation Process. By J. C. Watson. *Min. Geol. J.*, 1939, **2**, No. 1, 45-47. A brief account of the principles of cyanidation.

METALS

Aluminium and Bauxite

Aluminium and its Applications. By J. W. Cameron. *Canad. Min. Metall. Bull.*, 1939, No. 330, 445-464.

Aluminium and Highland Water Power. By W. M. Morrison. *Monthly J. Inst. Metals*, 1939, **6**, 457-476.

Alumina and its Use in the China Trade. By H. J. Plant. *Trans. Brit. Ceram. Soc.*, 1939, **38**, 476-484.

Aluminium Industry in Canada. By T. L. Bullock. Pp. 12, $6\frac{1}{2} \times 9$. (London: Aluminium Union, Ltd., Adelphi, Strand, 1939.) An account of the development and present status of light-metal production in Canada, in its technical, commercial, economic and political aspects.

Bauxite Deposits of Brazil. *Foreign Metals and Miner.* (*U.S.*), *Miner. Circ. No.* 20, 1939, pp. 5-11.

Cadmium

Cadmium. By L. Sanderson. *Canad. Min. J.*, 1939, **60**, 481-483. An account of the discovery, sources, production and uses of cadmium.

Chromium

Iron, Chromite and Nickel Resources of the Tennessee Valley Region. By E. C. Eckel, C. E. Hunter and P. W. Mattocks. *Geol. Bull. No.* 10. Pp. 26, $10\frac{3}{4} \times 8\frac{1}{2}$. (Knoxville: Tennessee Valley Authority, 1938.)

Copper

The Nickel-Copper Mining, Smelting and Nickel Refining Industry in Canada, 1938. *Min. Metall. Chem. Br., Canada.* Pp. 9, $11 \times 8\frac{1}{2}$. (Ottawa: Department of Trade and Commerce, 1939.) Price 25 cents.

The Copper Factor in German War Strategy. By P. E. Barbour. *Min. J.*, 1939, **207**, 921-922. Abstract from *American Metal Market*, September 27, 1939.

The Bruce Mine—A Brief History of Canada's Pioneer Copper Mine. By G. A. Cuthbertson. *Canad. Min. J.*, 1939, **60**, 424-426.

Some Observations on the Mineral Composition of the Mount Lyell Copper Ores, Tasmania, and their Modes of Occurrence. By A. B. Edwards. *Proc. Austr. Inst. Min. Metall.*, 1939, No. 114, 67-109.

Gold

Summary Review of the Gold Mining Industry in Canada, 1938. *Min. Metall. Chem. Br., Canada.* Pp. 72, 11 × 8½. (Ottawa : Department of Trade and Commerce, 1939.) Price 25 cents.

Favorable Financial Results attend New Gold Mine Development in Canada. By J. L. Maury. *Min. and Metall.*, 1939, **20**, 409-411.

Recent Smelting Practice at Noranda. By W. B. Boggs, J. N. Anderson and W. L. Stevens. *Canad. Min. Metall. Bull.*, 1939, No. 328, 416-428. Description of methods in operation at Noranda Mines, Ltd., Quebec.

The Geology of the Canadian Malartic Gold Mine, N. Quebec. By D. R. Derry. *Econ. Geol.*, 1939, **34**, 495-523.

Hollinger Shaft Practice. By V. J. Southey. *Canad. Min. Metall. Bull.*, 1939, No. 329, 481-499. A description of mining operations at Hollinger Consolidated Gold Mines, Ltd., Ontario.

The Gunnar Mine, Manitoba. By F. D. Shepherd. *Canad. Min. Metall. Bull.*, 1939, No. 328, 406-415. History and description of the Gunnar Gold Mines property in Manitoba.

The Privateer Mine, Zeballos, B.C. By G. F. MacDonnell. *Canad. Min. Metall. Bull.*, 1939, No. 327, 347-358. An account of the history, geology, mining and milling methods of the Privateer Gold Mine.

Some Geological Features of Kolar, Porcupine and Kirkland Lake. By E. Y. Dougherty. *Econ. Geol.*, 1939, **34**, 622-653. A comparative study of certain geological features of three of the world's important pre-Cambrian gold-quartz producing districts.

Notes on the Bendigo Goldfield, Victoria. By J. J. Caldwell. *Min. Geol. J.*, 1939, **2**, No. 1, 21-23.

Gordon Gold Mine, Gordon, Victoria. By J. P. L. Kenny. *Min. Geol. J.*, 1939, **2**, No. 1, 5-7.

Turton's Creek Goldfield, Victoria. By J. P. L. Kenny. *Min. Geol. J.*, 1939, **2**, No. 1, 51-52.

The Guildford Plateau Deep Lead Mine, Victoria. By J. B. Mulvaney. *Min. Geol. J.*, 1939, **2**, No. 1, 7-11.

The Chewton Mine, Victoria. By D. E. Thomas. *Min. Geol. J.*, 1939, **2**, No. 1, 11-14.

Gold Deposits at Opossum Creek, near Benarkin. By A. K. Denmead. *Queensland Govt. Min. J.*, 1939, **40**, 223-225.

Mareeba Goldfield. By C. C. Morton. *Queensland Govt. Min. J.*, 1939, **40**, 222-223.

Monal Goldfield—Lady Griffiths Reef. By S. R. L. Shepherd. *Queensland Govt. Min. J.*, 1939, **40**, 226-228.

Ore Occurrences in the Idaho Mine, Kalgoorlie, Western Australia. By A. J. Macgeorge. *Proc. Austr. Inst. Min. Metall.*, 1939, No. 111, 157-163.

Gold Mines of Mahad Dahab, Hedjaz, Saudi Arabia. By S. O. Hatton. *Min. J.*, 1939, **207**, 904.

Placer Operations of North Mindanao Mining Company, Surigao, Mindanao, Philippines. By W. F. Boericke and N. N. Lim. *Inform. Circ. No. 1, Bur. Mines, Manila.* Pp. 20, 9 × 6. (Manila : Bureau of Printing, 1939.)

Indium

Indium. By C. Reid. *Chem. and Industr.*, 1939, **58**, 837-838. An account of the occurrence, extraction and uses of indium.

Iron and Steel

Ironstone Mining in Cleveland. By J. R. Tomlinson and J. C. Dack. *Iron Coal Tr. Rev.*, 1939, **139**, 431-434.

Hematite Deposits, Steeprock Lake, Ontario. By M. W. Bartley. *Canad. Min. Metall. Bull.*, 1939, No. 327, 359-370.

Significance of the Iron Oxide Outcrop at Mount Oxide, Queensland. By R. Blanchard. *Proc. Austr. Inst. Min. Metall.*, 1939, No. 114, 21-50.

The Iron Ores of Yampi Sound, Western Australia. By F. Canavan and A. B. Edwards. *Proc. Austr. Inst. Min. Metall.*, 1938, No. 110, 59-101.

The Iron and Steel Industries of Europe. By C. W. Wright. *Econ. Pap. No. 19, U.S. Bur. Mines.* Pp. 98, 9 × 5¾. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 20 cents.

Heavy Industries of the German Reich. *Iron Coal Tr. Rev.*, 1939, **139**, 411-412, 438, 473, 475, 504, 542, 578. An analysis of the effect of a state of war in Europe on the sources of supply of essential raw materials for the German iron and steel industry, and on the export trade in iron and steel and solid fuels.

Die Eisenindustrie Rumäniens im Jahre 1938. *Montan. Rdsch.*, 1939, **31**, 468.

Iron, Chromite and Nickel Resources of the Tennessee Valley Region. By E. C. Eckel, C. E. Hunter and P. W. Mattocks. *Geol. Bull. No.* 10. Pp. 26, 10¾ × 8½. (Knoxville: Tennessee Valley Authority, 1938.)

Lead and Zinc

The Zinc Situation in 1938: European and World Trends. By O. W. Roskill. *Metal Ind., Lond.*, 1939, **55**, 145-148.

Die Aufbereitung von komplexen Blei-Zink-Schwefelerzen der Neuen Viktoria-Neuhof-Grube in Beuthen (Oberschlesien). By H. Glatzel. *Metall u. Erz*, 1939, **36**, 409-415.

Mining and Milling Methods and Costs at the Tennessee-Schuylkill Corporation Mine, Chloride, Arizona. By J. Schoder and P. T. Allsman. *Inform. Circ. No.* 7077, *U.S. Bur. Mines.* Pp. 20, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) The property consists of a lead-zinc ore containing gold, silver and a small amount of copper.

The Bunker Hill Smelter—a Modern Plant. By A. F. Beasley. *Engng. Min. J.*, 1939, **140**, No. 8, 61-71. Description of the method of production of refined lead, precious metals and other by-products at Bunker Hill, Idaho.

Mining by Cut-and-Fill and Square-Setting. By U. E. Brown and S. W. McDougall. *Engng. Min. J.*, 1939, **140**, No. 8, 43-46. Method of mining the Bunker Hill ore bodies, Idaho.

The Evolution of the Mill Flowsheet. By R. S. Handy. *Engng. Min. J.*, 1939, **140**, No. 8, 53-60. The development of the ore-treatment process at Bunker Hill.

Bunker Hill Ore Deposits in Complex Fractures. By R. H. McConnel. *Engng. Min. J.*, 1939, **140**, No. 8, 40-42. A summary of surface and underground geology of Bunker Hill and Sullivan holdings in the Coeur d'Alene district, Idaho.

Making Electrolytic Zinc at the Sullivan Plant. By W. G. Woolf and E. R. Crutcher. *Engng. Min. J.*, 1939, **140**, No. 8, 72-77. Description of method employed at Bunker Hill, Idaho.

Lithium

Lithium. By L. Sanderson. *Canad. Min. J.*, 1939, **60**, 549-551. An account of the sources, production and uses of lithium.

Magnesium

Magnesium. By L. Sanderson. *Canad. Min. J.*, 1939, **60**, 420-422. An account of the occurrence, production and uses of magnesium.

Production of Magnesium: New Methods directed toward Utilisation of Canadian Raw Materials. By L. M. Pidgeon. *Canad. Chem. Proc. Industr.*, 1939, **23**, 395-400.

Manganese

Manganese—What Will Germany Do? By E. A. Wraight. *Min. J.*, 1939, **206**, 876-877.

Cuban Development may solve U.S. Manganese Problem. By F. S. Norcross, Jun. *Min. and Metall.*, 1939, **20**, 380-383.

Molybdenum

Über ein Molybdänvorkommen in Jugoslawien. By G. Petunnikov. *Montan. Rdsch.*, 1939, **31**, 449-452.

Nickel

The Nickel-Copper Mining, Smelting and Nickel Refining Industry in Canada, 1938. *Min. Metall. Chem. Br., Canada.* Pp. 9. 11 × 8½. (Ottawa: Department of Trade and Commerce, 1939.) Price 25 cents.

Nickel Content of an Alaskan Basic Rock. By J. C. Reed. *Geol. Surv. Bull. No.* 897-*D*, *U.S. Dep. Int.* Pp. 263-268, 9 × 5¾. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 5 cents.

Iron, Chromite and Nickel Resources of the Tennessee Valley Region. By E. C. Eckel, C. E. Hunter and P. W. Mattocks. *Geol. Bull. No.* 10, Pp. 26, 10¾ × 8½. (Knoxville: Tennessee Valley Authority, 1938.)

Tin

Operations on Kikora Tinfield, New South Wales. *Chem. Engng. Min. Rev.*, 1939, **31**, 413.

Tin Lode at Garrawalt Creek, Queensland. By C. C. Morton. *Queensland Govt. Min. J.*, 1939, **40**, 184-185.

Tin Discovery at Mount Helen, Ingham. By C. C. Morton. *Queensland Govt. Min. J.*, 1939, **40**, 185-186.

Mining and Milling Methods and Costs at the Black Hills Tin Company, Tinton, S. Dakota. By J. R. Guiteras. *Inform. Circ. No.* 7084, *U.S. Bur. Mines.* Pp. 16, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Tungsten

Mining and Milling Tungsten at the Ima Mine, Idaho. By W. P. Barton and S. S. Arentz, Jun. *Min. J.*, 1939, **206**, 856-857. Abstract of an article appearing in the *Mining Congress Journal.*

Report on Tungsten Mines in Bolivia and their Future Possible Output. By C. W. Wright. *Miner. Tr. Notes* (*U.S.*), 1939, **9**, No. 3, 13-24.

NON-METALS

Asbestos

King Mine No. 3 Shaft and Equipment. By J. G. Ross and staff. *Canad. Min. Metall. Bull.*, 1939, No. 327, 371-396. A description of sinking and preparing a new shaft for operation by the Asbestos Corporation, Limited, Thetford Mines, Quebec.

Building Materials

Notes on the Lower Carboniferous Limestones and Toadstones at Mill Close Mine, Derbyshire. By J. G. Traill. *Bull. Instn. Min. Metall., Lond.*, 1939, No. 420, 34 pp.

Harcourt Granite, Victoria. By D. R. Dickinson. *Min. Geol. J.*, 1939, **2**, No. 1, 47-50.

Limestone at Heywood, Victoria. By J. P. L. Kenny. *Min. Geol. J.*, 1939, **2**, No. 1, 52-54.

Die nutzbaren Steine und Erden des Saarlandes und ihre Verwertung. By A. Graupner. *Z. prakt. Geol.*, 1939, **47**, 121-133.

The Oolitic Limestone Deposits of Franklin County, Alabama. By W. B. Jones. *Econ. Geol.*, 1939, **34**, 573-580.

China Clay

I Giacimenti di Caolino di Santa Severa. By F. de Carli. *Industr. Min. Ital. Oltremare*, 1939, **13**, 373-387.

Clay and Ceramics

A Unique Clay from the Goose Lake, Illinois, Area. By R. E. Grim and W. F. Bradley. *Rep. Invest. No.* 53, *Illinois State Geol. Surv.* Pp. 20, 9¾ × 6¾. (Urbana, Illinois : State Geological Survey Division, 1939.)

Coal, etc.

Modern Strip Mining of Coal brings changes in Preparation. *Min. and Metall.*, 1939, **20**, 451-452.

The Yorkshire, Nottinghamshire and Derbyshire Coalfield, Nottinghamshire and Derbyshire Area : Analysis of Commercial Grades of Coal—Part II. *Fuel Res., Phys. Chem. Surv. Nat. Coal Res. No.* 48, *Dep. Sci. Industr. Res.* Pp. 166, 9½ × 6. (London : H.M. Stationery Office, 1939.) Price 3*s*.

Reports of H.M. Inspectors of Mines under the Coal Mines Act, 1911, for the year 1938. II. Northern Division. By W. J. Charlton. *Mines Dep.* Pp. 71, 9½ × 6. (London : H.M. Stationery Office, 1939.) Price 1*s*.

Reports of H.M. Inspectors of Mines under the Coal Mines Act, 1911, for the year 1938. III. Yorkshire Division. By H. J. Humphrys. *Mines Dep.* Pp. 85, 9½ × 6. (London : H.M. Stationery Office, 1939.) Price 1*s*.

Reports of H.M. Inspectors of Mines under the Coal Mines Act, 1911, for the year 1938. IV. North Midland Division. By G. Cook. *Mines Dep.* Pp. 76, 9½ × 6. (London : H.M. Stationery Office, 1939.) Price 1*s*.

Reports of H.M. Inspectors of Mines under the Coal Mines Act, 1911, for the year 1935. V. North Western Division. By E. H. Frazer.

Mines Dep. Pp. 71, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 1s.

Reports of H.M. Inspectors of Mines under the Coal Mines Act, 1911, for the year 1938. VI. Cardiff and the Forest of Dean Division. By J. M. Carey. Pp. 36, 9½ × 6. (London: H.M. Stationery Office, 1939.) Price 1s.

Black Coal in Victoria. By I. C. H. Croll. *Min. Geol. J.*, 1939, **2**, No. 1, 35-36.

Dawson Valley Colliery, Baralaba, Mount Morgan, Ltd. By J. H. Reid. *Queensland Govt. Min. J.*, 1939, **40**, 256-257.

Coal-Mine Accidents in the United States, 1936. By W. W. Adams, L. E. Geyer and M. G. Parry. *Bull. No.* 420, *U.S. Bur. Mines.* Pp. 128, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 20 cents.

Friability, Slacking Characteristics, and Low-Temperature Carbonization Assays of Subbituminous Coals of the Denver (Colo.) Region. By V. F. Parry and J. B. Goodman. *Rep. Invest. No.* 3457, *U.S. Bur. Mines.* Pp. 12, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Carbonising Properties and Petrographic Composition of Pond Creek Bed Coal from Majestic Mine, Majestic Pike County, Kentucky. By A. C. Fieldner, J. D. Davis, W. A. Selvig, D. A. Reynolds, G. C. Sprunk and H. S. Auvil. *Tech. Pap. No.* 596, *U.S. Bur. Mines.* Pp. 46, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Carbonising Properties and Petrographic Composition of High Splint Bed Coal from Closplint Mine, Closplint Harlan County, Kentucky. By A. C. Fieldner, J. D. Davis, D. A. Reynolds, W. A. Selvig, G. C. Sprunk and H. S. Auvil. *Tech. Pap. No.* 599, *U.S. Bur. Mines.* Pp. 38, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

Burning of Coal in Down-Draft Ceramic Kilns and Burning Characteristics of some Ohio Coals. By W. E. Rice and C. R. Austin. *Tech. Pap. No.* 598, *U.S. Bur. Mines.* Pp. 34, 9 × 6. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.) Price 10 cents.

The Thriving Bootleg Anthracite Industry of Pennsylvania. By G. H. Jones. *Min. and Metall.*, 1939, **20**, 377-379.

Fuel and Power in Brazil. By J. R. Bradley. *Internat. Coal Tr. (U.S.)*, 1939, **8**, No. 8, 3-14.

Diamonds

The Diamond Industry in 1938. World Production. By S. H. Ball. *Min. J.*, 1939, **206**, 738-739, 759-760, 775-776. Abstract from *The Jewellers' Circular.*

Lime and Limestone

Graphic Survey of the Lime Industry, 1910-1938. By O. Bowles and A. T. Coons. *Inform. Circ. No.* 7088, *U.S. Bur. Mines.* Pp. 8, 10½ × 7. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Limestone as a Raw Material. By M. F. Goudge. *Canad. Min. Metall. Bull.*, 1939, No. 330, 521-526.

Magnesite

Lachute Map-Area: Part III, Magnesitic-Dolomite Deposits, Grenville Township. By F. Fitz Osborne. *Ann. Rep. Quebec Bur.*

Mines for the calendar year 1936. Part C, pp. 63-87, and map. (Quebec : King's Printer, 1938.)

Nitrates

In the Nitrate Fields of Chile. By H. L. Reichart and H. W. Schulz. *Chem. Metall. Engng.*, 1939, **46**, 464-466.

Petroleum, etc.

Gilsonite. By F. R. Jones. *Chem. and Ind.*, 1939, **58**, 800-801. An account of the occurrence of gilsonite, its properties and uses.

New Guinea Oil Search to be intensified. *World Petrol.*, 1939, **10**, No. 9, 23-25.

What of Canadian Oil ? By H. G. Cochrane. *World Petrol.*, 1939, **10**, No. 9, 31-36.

Alberta Oil : a Half-Yearly Review. *Canad. Min. J.*, 1939, **60**, 540-543.

Alberta Oil : Half-yearly Review, January 1 to June 30, 1939. By J. L. Irwin. *Dep. Lds. Mines.* Pp. 12, 6¾ × 5. (Alberta : King's Printer, 1939.)

Russian Oil Survey. Part IV. The Daghestan, Crimea, Kuban-Black Sea and Georgia Oilfields. By J. Wegrin. *World Petrol.*, 1939, **10**, No. 7, 52-58.

Russian Oil Survey. Part V. The Emba Oilfields. By J. Wegrin. *World Petrol.*, 1939, **10**, No. 8, 62-68.

Russian Oil Survey. Part VI. The Ural-Volga Region and Soviet Ukraine. By J. Wegrin. *World Petrol.*, 1939, **10**, No. 9, 54-60.

Russian Oil Survey. Part VII. Central Asia Area. By J. Wegrin. *World Petrol.*, 1939, **10**, No. 10, 54-57.

High Rate of Production indicated for Illinois Fields. By A. H. Bell. *World Petrol.*, 1939, **10**, No. 8, 30-36. A report on the geology, output and prospects of the area.

Oil and Gas Development in Illinois in 1938. By A. H. Bell. *Illinois Petrol., Press Bull. Ser. No.* 33. Pp. 28, 9¼ × 6¾. (Urbana, Illinois : State Geological Survey Division, 1939.)

Economic Effect of Recent Oil Discoveries in Illinois. By J. E. Pogue. *Min. and Metall.*, 1939, **20**, 447-448.

Estadistica de Petroleo de la Republica Argentina correspondiente al año 1938, por el Servicio Minero. *Publ. No.* 119, *Direcc. Minas Geol.* Pp. 55, 10½ × 7. (Buenos Aires : Ministerio de Agricultura de la Nacion, 1939.)

Brazil : Província Petrolífera do Nordeste. *Avulso No.* 41, *Div. Fom. Prod. Mineral.* Pp. 127, 9 × 6½. (Rio de Janeiro : Avenida Pasteur, 404 Praia Vermelha, 1939.)

Contribuição para a Geologia do Petroleo no Sudoeste de Mato Grosso. By G. de Paiva and V. Leinz. *Bol. No.* 37, *Div. Fom. Prod. Mineral.* Pp. 98, 9 × 6¼. (Rio de Janeiro : Avenida Pasteur, 404 Praia Vermelha, 1939.)

The Relationship of Structure to Petroleum Production in Eastern Venezuela. By W. Miller. *Econ. Geol.*, 1939, **34**, 524-536.

Quartz

Quartz Crystal in Brazil. By R. R. Winslow. *Miner. Tr. Notes (U.S.)*, 1939, **9**, No. 3, 40-47.

Rock Wool

Mineral Wool. By J. R. Thoenen. *Inform. Circ. No.* 6984*R.*, *U.S. Bur. Mines.* Pp. 62, 10½ × 8. (Washington, D.C.: Superintendent of Documents, Government Printing Office, 1939.)

Vermiculite

Vermiculite—Recent Developments and Uses. *Miner. Tr. Notes* (*U.S.*), 1939, **9**, No. 2, 25.

Vermiculite—A Mineral of Increasing Commercial Application. By C. C. Downie. *Chem. Age, Lond.*, 1939, **41**, 143-144.

EXHIBITION GALLERIES, FILM LIBRARIES AND CINEMA

NOTES

Exhibition Galleries.—Following the outbreak of war the Galleries were closed to the general public. The exhibits have, however, been kept intact, and have been available for inspection by officers from overseas, by inquirers and specially conducted school parties. Meanwhile additions and improvements to the exhibits have been introduced, and the opportunity has been taken to bring some of the older displays up to date.

The construction in the Imperial Institute studio by Mr. Montague B. Black of a diorama of the Port of Cochin marks the beginning of a separate Court for the Cochin State, thereby bringing it into line with Hyderabad, Mysore and Travancore, each of which States has a Court of its own in the Indian section. It is hoped eventually to arrange a comprehensive and permanent display illustrative of the life and scenery, the arts and the industries of the State.

The Port of Cochin is of great interest as its construction involved many problems, among which was the dredging of a deep-water approach channel three miles long—a task which, for a long time, was considered impracticable.

The label for the diorama reads as follows :

The Port of Cochin

The Major Seaport on the Malabar Coast of India.

" This diorama, which was presented to the Imperial Institute by H.H. The Maharajah of Cochin, shows the Port of Cochin from the air. In the foreground is the entrance channel with the Port on the right. In the middle distance is a huge reclamation area known as Willingdon Island furnished with up-to-date docks, jetties and warehouses.

" On the left is Vypeen, also a new reclamation area, used as an air field, behind which is Candle Island, and further in the distance the island of Bolghatty on which is the Residency and the golf course.

" In the background is Ernakulam, the capital of the Cochin State, with the Western Ghats in the far distance.

" Since the creation of a deep approach channel, three

miles long, and the construction of the new harbour, the Port of Cochin, with its extensive network of waterways, has become a very important distributing centre of Southern India.

" The principal exports are tea, cashew nuts, raw rubber, coir yarn, coir mats and matting, cotton, coffee, pepper, groundnuts, minerals and timber."

In the Burma Court, side by side with the exhibits of the country's economic wealth, an artistic and striking exhibit, designed and executed by Miss E. Tankard and Mr. W. Currall, of the Free Public Museums, Liverpool, has been installed to tell the story of Burma in terms of its spiritual and cultural values. Under the caption " The Romance of Burma " have been arranged statuettes and models in silver, bronze and ivory of traditional Burmese workmanship, set in a scenic background constructed of various kinds of Burma woods. The background of Burma teak plywood, presented by Teak Shippers Ltd., with its light and dark brown figure of a soft lustre, imparts a warmth that permeates the whole scene. On this background hills and trees, pagodas and houses, waterways and islands are designed and built up of superimposed layers of a variety of Burmese decorative woods, laurelwood, almond-wood and teak relieved by tulipwood, white chuglam and padauk. The general effect is an artistic and colourful representation of typical Burma scenes in wood appliqué. Merging into each scene and forming a harmonious whole are groups of objects and figures in silver, bronze and ivory representing religion, village and home life, transport, the *pwe* theatre, recreation, and forestry. On either side of these scenes are draped examples of the celebrated shot silks of Mandalay.

Another happy addition to the Burma Court consists of portions of the façade of the Burma Pavilion which was an object of admiration to thousands of visitors at the Empire Exhibition, Glasgow. This façade is a good example of Burmese ornamental carving in teak as applied to architecture. The spandrels are a mass of foliation culminating in a figure of the peacock in his pride, the national emblem of Burma. Above this is shown one of the ornamental eave-boards of the Burma Pavilion. This consists of symbolic floral designs in graduated flame-like spires, slightly inclining inwards towards the centre. The whole fixture, with a carved finial on either side, constitutes an artistic background for the comprehensive display of teak and its many modern uses which it is hoped will be added to this exhibit in the near future.

To the mineral section of the Burma Court has been added, through the courtesy of the Government of Burma, a collection

of jade and jadeite in the form of rough and cut stones, and a series of photographs. The photographs have been enlarged and are used to give effective support in telling the complete story of jade from the rough boulder to finished articles of personal adornment.

Side by side with jade and jadeite, a few pieces of Burmese amber or "burmite" have been exhibited, together with a photograph showing the workers extracting amber at a mine. Burmese amber differs slightly in chemical and physical characteristics from other known varieties, and is distinguished by the name "burmite." It is harder and denser than amber and is of a dark brown colour.

Through the generosity of Sir R. Edward Stubbs, G.C.M.G., K.C.B., C.B.E., a former Governor of Ceylon, two Maldive mats, each measuring about 7 ft. 9 in. by 2 ft. 6 in., have been presented to the Imperial Institute for the Ceylon Court. These are displayed on the wall in the bays on each side of the mural paintings of the perahera. Situated about 400 miles to the west of Ceylon, the Maldive Archipelago consists of numerous groups of coral islets, governed by a Sultan, who pays allegiance to, and enjoys the protection of, the British Government. The mats, of palm leaf strips in striking geometric designs in black and white on saffron background, are part of the annual tribute which is paid by the Sultan of the Maldives to the Government of Ceylon.

To the East African Court has been added a diorama representing cultivation and harvesting of cotton in Uganda, designed and constructed in the Imperial Institute studio by Mr. A. J. Carter. The descriptive label attached to this diorama reads as follows:

Cotton: Uganda's Chief Export Crop

"In Uganda the cultivation of cotton is a highly successful peasant industry, the crop being grown by Africans on many thousands of small plots as a cash crop supplementing their usual food crops.

"This diorama shows a typical scene in the cotton area, the growing cotton at different stages of development occupying the central portion of the model. Women are seen harvesting the crop from the plot bearing the ripened bolls, this work being done early in the day before the heat of the sun becomes too great.

"In the foreground women are bringing in the cotton they have harvested to the drying ground near the huts where it is spread out to dry before being made up into bundles for transfer to the ginnery.

"A modern ginnery is seen in the background on the right. Here, by means of machinery, the cotton lint is

separated from the seed, a process known as ginning. Bales of cotton and sacks of seeds are seen near the ginnery ready for transfer to the railway for conveyance to a shipping port.

" On the left are native huts with a background of bananas, whilst a 'Flame tree' in bloom adds a splash of colour. Bordering the motor roadway to the ginnery are nsambya trees which bear clusters of yellow flowers, and in the background are green hills, typical of Uganda, clothed with scrub and trees."

A further addition to our collection of statuettes is a replica of the Nairobi Delamere Memorial by The Lady Kennet, K.C.B., A.R.C.S. The statuette, which is in bronze, is mounted on a polished ebonised pedestal, and stands in the East African Court overlooking the relief model map of East Africa. The label attached reads as follows:

Lord Delamere

(1870-1931)

Pioneer and Leader of the White Settlers in Kenya

" Lord Delamere (Hugh Cholmondeley), born on April 28, 1870, succeeded his father as third baron at the age of 17.

" He entered the army, but early in life set out on the adventurous life of an African pioneer. In 1897 he first entered Kenya on a big game expedition, and after much travel finally settled on the land and made Kenya his home. Convinced of the great opportunities awaiting white settlers in the Highlands, he acquired several thousand acres of land before the railway had reached Nairobi. He developed schemes for the future, rather than for immediate results, and it is to his activities and foresight that Kenya to-day owes its prosperous industries. He introduced schemes for bringing water through pipe-lines from distant hills to irrigate new land for settlement, and he became the central figure of the settler community.

" After the Great War, when soldier settlement schemes were formed by the Imperial Government, he sold part of his land to the new settlers, and gradually forsook pioneering. He became a statesman and member of the Legislative Council, devoting the latter part of his life to political activity and leadership, and co-operated in many forms of Government research.

" Believing that the future of Central Africa depended on the existence of a settled white population, he initiated several unofficial conferences which brought together representatives of white settlers from as far afield as Nairobi and Livingstone.

" In 1929 he was created K.C.M.G. as a tribute to his work for the Empire. He died on November 13, 1931."

Other additions to the East African Court are a series of photographs forming a travelogue under the caption "Zanzibar—The Island Home of the Clove Industry," prepared from negatives kindly loaned by Mr. F. B. Wilson, of the Department of Agriculture, Zanzibar; and photographs of mica mining and of tin washing in Tanganyika Territory, generously donated by Sir Edmund Teale.

To the South African Court has been added a "story" exhibit of the South African iron and steel industry generously presented by the South African Iron and Steel Industrial Corporation, Ltd. The story from the raw material to the production of pig iron and steel is traced by means of photographs and specimens. Among the finished articles shown as examples of typical products of the industry are sections of rails, beams, girders, mine shaft guides and "fish-plates" or connectors, angles, rods and flat bars, together with a specimen of galvanised sheet.

Through the generosity of Mr. W. A. Fortens, A.R.P.S., official photographer to the Peninsular and Oriental Steam Navigation Company, the Tristan da Cunha Court has acquired a selection of mounted enlargements from the unique collection of photographs obtained by Mr. Fortens when s.s. *Viceroy of India* visited the island; also from three of his negatives transparencies for the window of the Court have been prepared.

The West African hides and skins story exhibit referred to in the previous number of this BULLETIN has now been completed. The additions include enlarged photographs of types of cattle and market scenes prepared from negatives kindly loaned by the Export Advertising Service, Ltd.

A model of a dug-out fishing canoe, presented by Mr. H. E. Green, of the Agricultural Department, Gold Coast, has been placed on exhibition in the Gold Coast Court.

On the north wall of the West African Court have been displayed the large mural photographs of forestry, agriculture, and local life, the native hand-woven silk cloths and the coloured transparencies, all of which were transferred at the close of the Empire Exhibition at Glasgow.

To the Cyprus Court, under the title "Carobs—The Consols of Cyprus," has been added a story exhibit which helps to convey to the visitor the importance of this, the principal export crop of the island, and the part that carobs and carob products play in industry. The exhibit starts with a photograph of a typical grove of carob trees, and then shows one of a tree itself. These are followed by specimens of the beans as harvested, and a further series of photographs illustrating various stages in their storage, handling, and eventual export as whole carobs, kibbled carobs or carob meal, concluding with samples of the proprietary cattle foods

made in the United Kingdom, in which carobs form a valuable ingredient. A further section of the display shows in turn the carob seeds obtained as a by-product in the kibbling mills, the stages through which they pass in the manufacture of carob gum, and finally examples of the uses of carob gum in industry. The material for this exhibit was obtained through the kind co-operation of the Department of Agriculture in Cyprus and of the London Office of the Cyprus Government.

An important and picturesque addition to the Canadian Court, rendered possible by the generosity of the Board of Governors of the Hudson's Bay Company, is a diorama of one of the Hudson's Bay Company's fur-trading posts in Northern Manitoba. The artist, Mr. Herbert H. Cawood, who designed and constructed the diorama in the Imperial Institute studio, has succeeded very ably in capturing the general atmosphere of the "Frozen North," and has well illustrated the various activities at one of these posts.

The descriptive label attached to the diorama reads as follows:

Dominion of Canada

A Fur-trading Post of the Hudson's Bay Company.

"This diorama depicts a winter scene at a Hudson's Bay Company fur-trading post in the virgin forests of Northern Manitoba. To these posts trappers and fur traders bring their annual catch of beaver, lynx, marten, muskrat, otter, mink and fox skins, and exchange them for guns, ammunition, blankets, clothing, lard, biscuits, molasses, etc.

"On the right is the original log hut erected when the post was first formed and now used as a general utility shed. To the left of this is the modern store; farther distant is the fur storehouse, and to the left again are the living quarters of the manager of the post and his staff. These are the standard type of building now used at every H.B.C. post and are sent north in sections ready for erection. A central feature of every post is the flagstaff from which is flown the house flag, bearing the letters H.B.C., which are locally interpreted 'Here Be Cheerful.'

"The scene shows the arrival of a party of fur traders with their load of furs drawn by a team of huskies. Their arrival is awaited by the manager and is regarded with interest by two of the staff who have paused in their task of providing winter fuel. In the middle distance, partly buried in the snow, are a number of steel drums used for the transport of oil, molasses and other goods requiring substantial protection.

"Crossing the frozen river to the left is another party of traders, and overhead is one of the Company's aeroplanes which provide transport for mails, furs and trade goods.

Before the introduction of aircraft, many such posts could only be reached by canoe journeys, which involved dangerous navigation of rapids and the portaging of supplies where river navigation was impossible."

Improvements in several of the show-case displays in the Canadian Court have been rendered possible by the addition of pictorial posters and several individual exhibits kindly supplied by the Director of Canadian Exhibitions and Publicity in London.

Towards projected improvements for the British Honduras Court, a series of forty-three photographs, dealing with the cultivation of cassava in British Honduras and the manufacture of cassava starch, have been received from Empire Starch Products, Ltd., a Canadian company operating in British Honduras. A sample of the starch itself has also been received.

Through the kindness of the Bermuda Trade Development Board a grant has been sanctioned for the construction of a diorama giving a view of the sea gardens and the remarkable fish for which Bermuda is famous. The preliminary sketch by Mr. Ernest Whatley has been submitted to and approved by the Board, and the actual construction of the diorama is well in hand.

In the British Guiana Court two story exhibits dealing with characteristic export products have been arranged. The first, under the heading " From Forest to Factory—The Story of a Balata Belt," traces, by photographs and specimens, the successive stages of evolution, from the winning of the latex by the tapping of balata trees in a British Guiana forest with the interesting tree-climbing operation, to the coagulation of the latex, the formation of sheet balata, and its subsequent use in the manufacture of power belting, with photographs of typical transmission belts in a paper mill and a gas works. In preparing this exhibit, the co-operation of the Turner Brothers Asbestos Company of Rochdale is gratefully recorded.

The second story, bearing the title of " How we get our Demerara Sugar," is even more comprehensive. On one side of the showcase, the first chapter, " From the Field to the Mill," illustrates a typical British Guiana sugar estate, and shows very graphically the cultural operations needed to bring the crop to maturity, as well as the cutting and transport of the canes to the mill. On the other side of the case, a second chapter, " From the Mill to the Market," shows, equally vividly, the crushing of the cane, and the stages in the conversion of the cane juice into the well-known Demerara sugar of the breakfast table. In the process the valuable by-products obtained are also represented and their uses in the fabrication of other goods are indicated.

A third story dealing with the important rice industry in British Guiana is under arrangement, and schemes for other stories covering gold and diamonds are projected.

To the New Zealand sheep-skin exhibit has been added a series of miniature skins to tell the story of the splitting of the skin and the treatment of the top grain half or skiver in the preparation of fancy leathers. The series comprises skins partly split, tanned, dyed, seasoned to give a good wearing surface, and finished leathers glazed and embossed. The under flesh half of the skin, employed for chamois leather, is also shown. The miniature skins were presented by Messrs. James Garnar & Sons of Bermondsey.

In the Australian Court two large showcases have been fitted with dividing screens, thus providing backgrounds for the arrangement of four distinct story displays. One of these, an exhibit telling the story of Australian wheat from the ploughed field to the finest wheat flour, has now been arranged. Starting with photographs of the cultivation and harvesting of wheat, the exhibit goes on to show examples of the grain as harvested, the impurities removed in the cleaning processes, four stages in the breaking down of the grain in order to eliminate the skin or bran, the different flours produced by the reduction rollers, and finally a sample of the finest finished "Key-note" flour.

Lifelike coloured wax models of twenty-one different varieties of Australian apples of the kinds now exported to this country have been received for the Court from Australia House and are exhibited in place of older models. A number of carbon photographic window transparencies have been added to those previously installed in the Australian Court. Examples of lead pipe, lead sheet and of lead sink traps of various descriptions have been acquired for the Australian lead exhibit through the kind offices of the Lead Industries Development Council.

In the Hong Kong Court a three-fold Chinese screen, presented by Sir R. Edward Stubbs, G.C.M.G., K.C.B., C.B.E., a former Governor of Hong Kong, has been exhibited on the wall of the Court. The central panel bears a Chinese embroidered design in coloured silk, and the two side panels show carved floral designs in blackwood. For display purposes the three leaves of the screen have been detached, and are shown in association with a wall-case exhibit of local Hong Kong handicrafts.

In the British Malaya Court some of the exhibits illustrating rubber manufacture have been renewed and brought up to date by the Dunlop Rubber Company. The new exhibits illustrate, by photographs and samples arranged in story fashion, the mastication and compounding of raw rubber on

arrival in this country, and its use in the manufacture of motor and cycle tyre tubes and covers. The manufacture of cotton casing fabric which forms a considerable part of the motor cover is also illustrated. Another story exhibit, also supplied by the Dunlop Rubber Company, starts with rubber latex and illustrates the making of cushion rubber for Dunlopillo seating, whilst the making of a rubber Wellington boot is the subject of a story exhibit supplied for this Court by the North British Rubber Company.

Empire Film Library.—Owing to the rapid expansion of the Empire Film Library, and the displacement of old or worn films by new material, a new edition of the Catalogue was found to be necessary. The opportunity was taken to introduce a subject index in addition to the index by countries, and the new and enlarged catalogue, giving particulars of 2,000 prints, was prepared and placed on sale in September, price 6d. (post free 7d.). It is some indication of the popularity of the Library that by the end of the year over 1,000 copies of the Catalogue had already been distributed.

Colonial Visitors.—The following is a list of officers on leave from the Colonies, etc., who have visited the Institute during the three months August-October 1939.

August

A. J. Arkell, Commissioner of Anthropology and Archæology, Khartoum Museum, Khartoum.
H. L. Bayles, C.M.G., Financial Secretary, Nigeria.
G. S. Brown, Agricultural Assistant, Tanganyika Territory.
H. Gillman, Agricultural Officer, Tanganyika Territory.
H. E. Green, Inspector of Plants and Produce, Gold Coast.
A. E. P. Kershaw, Senior Inspector of Mines, Federated Malay States.
P. L. le Roux, Veterinary Research Officer, Northern Rhodesia.
A. F. Mackenzie, Agricultural Officer, Sierra Leone.
Captain P. F. Masterton-Smith, M.C., District Officer, Nigeria.
R. G. Miller, Assistant Conservator of Forests, Northern Rhodesia.
C. E. Milner, Conservator of Forests, Burma.
R. F. A. L. Reed, Agricultural Officer, Nigeria.
J. L. C. Rodrigo, Lecturer in Classics, Ceylon University College.
J. I. Taylor, Veterinary Officer, Northern Rhodesia.
N. H. Vicars-Harris, Secretary, Lands and Mines Department, Tanganyika.

September

J. P. Edwards, Assistant Conservator of Forests, Straits Settlements and Federated Malay States.
Dr. F. T. Ingham, Mining Geologist, Federated Malay States.
J. W. Macaulay, Veterinary Officer, Bechuanaland.
A. E. S. McIntosh, Assistant Director of Agriculture, Barbados.
Captain L. Nicholls, M.C., Senior Assistant Conservator of Forests, Nigeria.
H. R. Oke, C.M.G., M.C., Colonial Secretary, The Gambia.
S. H. Shaw, Geologist, Palestine.

OCTOBER

M. H. FOX, Government Analyst, Kenya.
Captain W. W. HENDERSON, Director of Veterinary Services, Nigeria.
B. JONES, Geologist, Nigeria.
J. McDONALD, Director of Agriculture, Cyprus.
F. R. MASON, Deputy Director of Agriculture and Fisheries, Palestine.

All Dominion and Colonial officers, as well as private residents overseas, who may be visiting London, are cordially invited to come to the Institute to see our Exhibition Galleries and to discuss scientific and technical problems in which they may be interested.

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Scientific names and titles of books are printed in italics and personal names in capitals